

Aviation Week & Space Technology

July 23, 1962

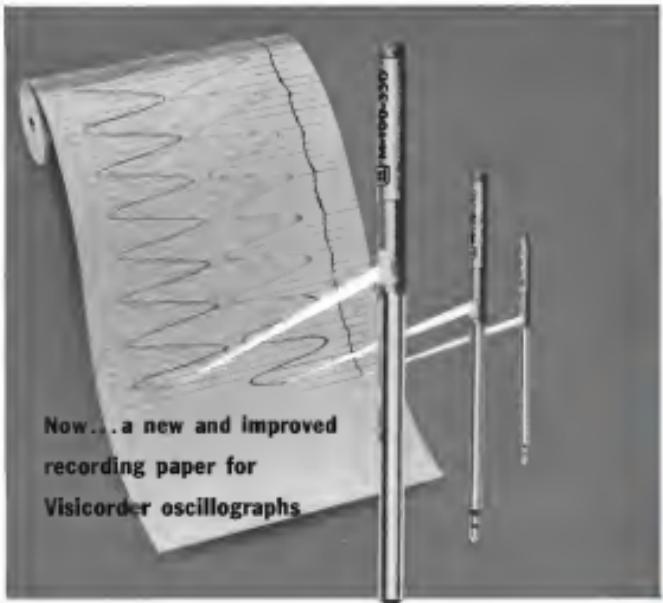
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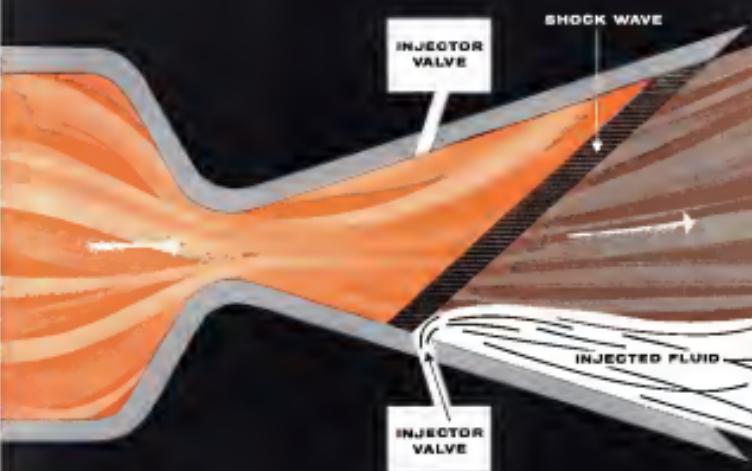
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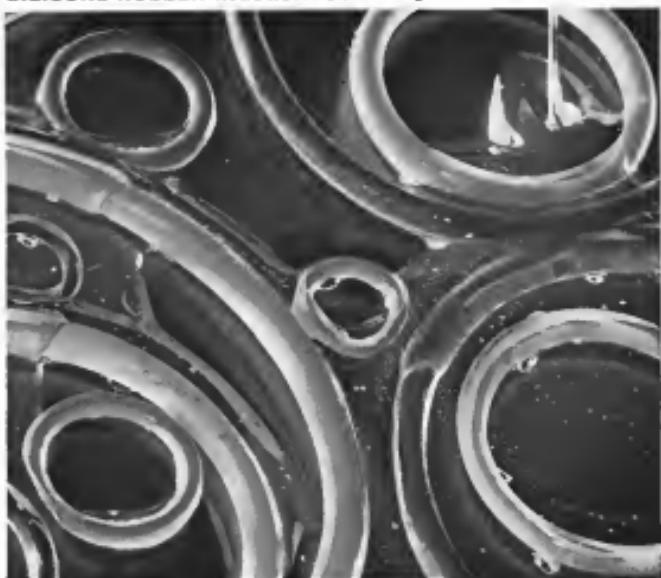
CAPABILITY is spelled s-e-c-o-n-d-a-r-y i-n-j-e-c-t-i-o-n

The Aerospace Division of Vickers Incorporated has successfully completed a secondary injection thrust vector control system R&D program for the United States Navy.



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AEROSPACE CALENDAR

Aug. 13-Electrospun Emissary's Research Conference on Composite Materials: Texas School, Tulsa N.H.

Aug. 8-Experimental Aircraft Assn. Fly In, Randolph Airport, Rockford, Ill.

Aug. 10-12-Altair's Annual Technical Symposium, Santa Barbara, Calif. Industratech Engineers in cooperation with the Altair Systems Company, Santa Barbara, Calif.

Aug. 11-12-Electrospun Emissary's Research Conference on Composite Materials: Texas School, Tulsa N.H.

Aug. 12-14-International Wind Conference, Winter Haven, Calif.

Aug. 13-15-Petroleum, Gasoline, the Pita Pan Spanish American Petroleum Society: U.S. 5 Army Signal Moon Support Agency (Aug. 9 session in Dallas)

Aug. 17-19-TRIST (Tunisia Evaluation and Research Institute for Science and Tech) Fifth National Seminar: STI Data from Center, Tunis, Tunisia N.J.

Aug. 17-18-17th Meeting: National Aerospace Standards Committee, AIA, Research Institute, Herk, Scotts, Ohio

Aug. 18-20-1983 National Laboratories Conf. Series: National Bureau of Standards Boulder Laboratories, Boulder, Colo.

Aug. 20-23-1983 National Institutes of Health: Man-Machine Competition: Chicago, Ill.

Aug. 21-Sept. 1-Indochina World Fencing Championship, Orange, Mass. Sponsored National Association, New Fencing Club of America

Aug. 13-16-Poly-Energy Corporation, Co., National Institute of Electrical Engineers, Princeton Hotel. See Poly-Energy

(Continued on page 7)

AVIATION WEBCAST Series: Technology

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第三章 中国古典文学名著

Postscript: Please send this note to Fulbright Rep. Bill Gandy, Washington, D.C. 20520, and to Senator Ted Kennedy, Washington, D.C. 20510.

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AEROSPACE CALENDAR

(Continued from page 5)
Aug. 13-16—Second Symposium on Reliability, Materials and Space Technology, U. S. Air Force Academy, Colorado Springs, Colo. Sponsored USAF, Aerospace Corp.

Aug. 14-16—Cognex Engineering Conference, University of Southern California, Los Angeles, Calif.

Aug. 14-17—International Conference on Fusion Electromagnetic Measurements, Boulder Laboratories, National Bureau of Standards, Boulder, Colo.

Aug. 17-19—Nuclear Propulsion Conference, Moraine, Calif. Sponsored Materials Institute of the Nuclear Society. American Nuclear Society, Los Angeles, Calif.

Aug. 19-21—First International Electrotechnical Conference, Pasadena, University of California, Los Angeles, Calif.

Aug. 19-29—Larousse Encyclopedie, Larousse Flying Corps and Association of the French Foreign Legion, in Houston Area, Fort Worth, Texas.

Aug. 19-21—Annual Meeting and Conference, American Defense Council, Francis Scott Key Hotel, Washington, D. C.

Aug. 20—Technical Symposium, Precision Potentiometer Manufacturers Assn., Hotel Hyatt, Los Angeles, Calif.

Aug. 21-24—Western Electronics Show and Conference, Institute of Radio Engineers, Los Angeles, Calif.

Aug. 21-24—International Symposium on Infrared Spectroscopy, Shizuoka City, Japan. Sponsored, Optical Materials, Control, Aeronautical Systems Division, Air Force Systems Command.

Aug. 21 Sept. 27-145 Session, Scientific Council, International Organization for Standardization, Geneva, Switzerland.

Aug. 23-24—Quarterly Regional Meeting, Assn. of Local Transport Airlines, White Hotel, Anchorage, Alaska.

Aug. 23-24—Conference on Thin Films, Claude Hard, Cleon Springs, Colo. Sponsored, Solid State Electronics Laboratory, University of Denver Research Institute.

Aug. 27-29—AIME Technical Conference on Advanced Electronic Materials, Materials Park, Wash. Sponsored, Institute of Metals.

Aug. 27-29—3rd Annual International Conference, International Council of the Aerospace Sciences, New Congress Hall, Stockholm, Sweden.

Aug. 27-Sept. 1—Infrared International Conference, International Institute of Infrared Sciences, Moscow.

Aug. 28-29—Fourth Conference on Measurability of Electronic Equipment, Electronic Industries Assn. in cooperation with Department of Defense, University of Colorado Boulder, Colo.

Sept. 3-5—National Advanced Technology Management Conference, Institute of the Aerospace Sciences, Seattle, Wash.

Sept. 3-7—International Symposium on Information Theory, Institute of Radio Electronics, Brussels, Belgium.

Sept. 3-6—1962 Flying Display and Vehicle Show, 36th Annual Model Aircraft Convention, Franklin Park, Ill.

Sept. 4-7—National Advanced Technology Management Conference, Open House, (Continued on page 9)

Four important questions you should ask before selecting any scientific or engineering computer.

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(3) Will your house be here when you buy a computer?

Some companies are so anxious to buy a computer that they buy it before they even know what they want. Others are so simple that engineers can explain their problems directly. This ease of programming solves their and increases computer use. One of the easiest computers to program and operate is a Recomp. Engineers with less than eight hours instruction are able to use the computer profitably.

(4) What will a computer do for you?

You'll probably never know the complete answer to this until you have an on your own house. The computer can be programmed to do many things in addition to the one that originally bought the computer for. But some companies buy a computer for one purpose and then don't use it. For example, a company that once got 2 percent a year from a top profit scientific consultant, was able to increase this figure to 31/2 with a computer (Recomp). But with Recomp this company is now able to get nine percent each year.

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AEROSPACE CALENDAR

(Continued from page 7)

Sept. 17-20—Symposium on Measurement of Thermal Radiation Properties of Solids. Institute Max-Planck (Office: Max-Planck-Institut für Strahlungsforschung, 8000 Münster, FRG; USAP: National Bureau of Standards, NBS).

Sept. 19-24—Fourth National Conference on Applied Meteorology, American Meteorological Society, Lexington, Va.

Sept. 18-19—Annual General Meeting, Infrared Division, American Assoc. of Physics.

Sept. 13-14—10th Annual Engine Manifolds Conference, IRE Hotel, New Orleans, La.

Sept. 17-18—Hydrogen & Air Compressors Meeting, Institute of the Aerospace Sciences, Research Blvd., Washington, D.C.

Sept. 18-19—Research in Space: 1962 Space Research Symposium, El Tropico Hotel, San Antonio, Tex. Sponsored by Astronautical Research Office of the Office of the Chief of Ordnance, Assigned to Southwest Research Institute.

Sept. 15-17—6th National Commission & Astronautics Plasmatics, Las Vegas, Nev.

Sept. 15-20—Technical Management Utilization Meeting, Institute of the Aerospace Sciences Hotel, Columbus, New York.

Sept. 19-20—Operations & Maintenance Symposium, Aerospace Corp., Malibu, Calif.

Sept. 19-21—12th National Conference on Tide Telemetry, Western Union, Atlantic Avenue, New York, N.Y. Sponsored by American Co. on Electronic Devices.

Sept. 21-22—1st International Agricultural Aviation Conference, National Agri-Airport Aviation School, Cagayan de Oro, Philippines.

Sept. 24-26—12th International Air Transport Assembly, The Fair, Copenhagen, Denmark.

Sept. 21-26—Space Power Systems Conference, American Rocket Society, Mission Hills, San Mateo, Calif.

Sept. 24-Oct. 1—1962 General Conference of the International Astronomical Union.

Sept. 25-26—Society of Experimental Test Pilots Sixth Annual Awards Banquet & Symposium, Beverly Hills Hotel, Beverly Hills, Calif.

Oct. 1-3—National Space Exploration Symposium, Mr. Space Control Annex, Flamingo Hotel, Las Vegas, Nev.

Oct. 4—Third Symposium on Advanced Propulsion Concepts, Cincinnati, Ohio. Co-Sponsored AFOSR, General Electric.

Oct. 24—National Symposium on Space Power and Propulsion, Institute of Radio Engineers, Fontainebleau Hotel, Miami Beach, Fla.

Oct. 8-12—National Aerospace & Space Engineering & Manufacturing Meeting & Display, Society of Aerospace Engineers, Las Vegas, Nev.

Oct. 11-12—1962 Meeting, Research Board, Mass. Sympos., Institute of the Aerospace Sciences, U.S. Navy.



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straight successful space mission by boosting the Telstar into orbit. Telstar Project Director Eugene F. O'Neill and his associates also merit an accolade.

One of the initial Telstar experiments is the layman who reads the earth sciences, watching days or radio with the amazing clarity of its voice transmissions and instantaneous television broadcasts. In fact, that high quality transmission to surprised electronically sophisticated Philip Klass, *Amateur Radio & Space* Transactions' associate editor, that he authorized became the first to receive playback back from space through a satellite. No one who watched the initial television from Telstar on its sixth orbit could avoid experiencing the clear impact of the satellite stations or fail to feel its significance for the future. And a parsimonious usage of national space was in order when the first transmission through space showed the American flag and played "The Star Spangled Banner."

Within several years, millions of people around the earth will witness the first live global television via communications satellites. Recognizing the powerful political and social influence that domestic television has already demonstrated, global television may well be the most significant peaceful application of space technology for at least the next several decades.

Telstar's successful performance under a blustery off

the launch pad at Cape Canaveral on July 10 has certainly authenticated the first half of that prediction and opened the way toward fulfillment of the rest.

Triumph of Technical Skill

In its brief orbital existence, Telstar has become one of the brightest lights in the U.S. space program. It has achieved a significant and dramatic test for this nation in space performance that can easily be grasped and understood by everybody. It is also further demonstrated, along with the Telstar weather satellites, of what space technology can offer to improve life on earth in the immediate future. It is a significant triumph for the technical skill and management foresight of U.S. private enterprise working in unique partnership with its government.

When laurels are distributed for Telstar's performance, as indeed they were, it would be well to start with Dr. John Pierce of the Bell Telephone Laboratories, who was the first in this country to suggest the use of space satellites for a communications system and to analyze the design possibilities of such a system. AT&T's management and its Bell System allies have invested at least \$5 million in direct launch costs, another \$10 million in the ground terminal at Andover, N.H., and many more millions in research on the new technology that made Telstar possible. In addition to this U.S. corporate investment, the initiative displayed by AT&T in taking full advantage of former President Eisenhower's facilities after stimulated England and France to build ground stations in time to participate in the initial experiments with Germany and Italy also contributed to build their own facilities and Japan almost were to follow.

Credit must also be given to the Bell Labs for their initial work in creating the transistor and the silicon solar cell, without which Telstar and many other types of satellite would not be possible. And the old reliable Douglas Thor Delta booster with upper stages by Aerojet and Allegany Ballistic Lab registered its tenth

Intelligent Programming Required

While American industrial enterprise, as typified by AT&T's Telstar program, has given the world a fair example of how the U.S. system can make function, it behooves the television network executives to display considerably more statesmanship and intelligence than they have yet exhibited in their dovetailing, progressing to provide proper service the world over with the one, best example of what fine country really has to offer. If all Telstar serves to accomplish is to spread domestic television programs truly on a global scale, it will indeed prove to be a sorry advancement of the American image.

Politically, the fate of the U.S. communications satellite network's corporate structure and operational substance is still being debated in Congress. We think the amended version of the Kennedy Administration's bill on this subject is about as good an approach to the problem as is possible at this time. We think private ownership with opportunity for public participation and gain for a watchful governmental observation is far preferable to complete public ownership of this type facility.

So Telstar has now joined Mercury and Triton in the strong success of the U.S. space program and offers further proof that the conquest of space is really hitched to the pace of a galloping technology.

—Robert Holt



WHO'S WHERE

In the Front Office

Tucson's Bell Aerospace Co., Bellanca, N.Y., has announced the following appointments: Morris C. Wilkes, vice president finance; John M. Schlesinger, Jr., a vice president; Richard H. McKit, treasurer; Joseph F. Coughlin, secretary; Romeo J. Herting, controller.

R. S. Sturte, president, Dherbier Partner Corp., Los Angeles, Calif. Also F. E. Hale, a vice president; R. Schlesinger, vice president; F. J. Zorn, treasurer.

John E. Johnson, vice president and general manager, North American Latin American Hercules, Calif. Johnson was most recently general operations manager of Aerospace's Space Systems Operations.

De Robert G. Ulrich, vice president-engineering, and Robert D. Johnson, vice president-facilities, Inc., Consolidated Vacuum Corp., Rochester, N.Y.

Knell S. Hadden, vice president and general manager, The Mead Corp., Dayton, Ohio, a subsidiary of The Boeing Co.

W. Neil Ross, president, Incet, Inc., Lockheed Aircraft Corp., Portland, Calif., was elected vice chairman of the board and executive president of Lockheed Aircraft Systems.

Edward L. Daskalakis, a vice president, Raytheon Co., Lexington, Mass. Mr. Daskalakis continues as division manager of the Space and Power Division.

Joseph P. Tamm, vice president-manufacturing, Standard Kalman, Inc., Melville, N.Y.

William R. Swanson, vice president-project operations, Electrospace, Inc. and manager of the Washington, D.C. office, presented the following new positions: William C. Conner, vice president; Fred N. Rappaport, manager; Fred D. Winklerman, vice president.

Charles A. Stroh, vice president-marketing, GTE, Denver, and General Precision, Pleasantville, N.Y.

Robert A. Marshall, vice president, Federal Electric Corp., Princeton, N.J. Mr. Marshall continues as director of marketing.

Albert Stengel, executive vice president, Allis-Chalmers Corp., New Berlin, N.Y. Also Lawrence L. Martin, vice president Finance Division; Charles P. Johnson, vice president, Government Products Division.

Bob G. Allens, T. Colander, vice commander, Aerospace Systems Division, Wright-Patterson Air Force Base, Ohio, and Robert E. Johnson, Air Force Ground Control Center, Eight AFM, Fla., on Aug. 31.

Honors and Elections

Philip G. Goss, vice president and managing director of the Hawker Aircraft of Canada, Ltd., has been named an Honorary Fellow in the Canadian Aeronautics and Space Institute.

John C. Goss, president of American Machine & Foundry Co., has received the U.S. Air Force Ballistic Systems Division Commander's Award for outstanding service to the Division. AFM is an associate contractor in the Titan II program.

(Continued on page 81)

INDUSTRY OBSERVER

Korean Aircraft Corp. is flying a testbed version of its K-600-3 Hauke, 3 twin-engine follow-on to the firm's H-43B helicopter. Not version, developed with company funds, it is designed for non-paving missions, especially in counterinsurgency operations. Hauke 3 has a single-blade configuration instead of the H-43's two-blade. Changes are concentrated in the drive system, but the current model is flying with a stretched H-43B rotor system. Cabin of the Hauke 3 has been enlarged over previous versions and windows have been added.

•Feasibility of using a portion of a spaceplane structure itself as a rocket motor nozzle is being investigated by National Aeronautics and Space Administration. Standard current practice is to use a separate, manufactured nozzle.

•Adaptive flight control systems proposals for TFX-In-service fighter designs have been requested by General Dynamics (Ft. Worth). Studies provide variable control surfaces over a wide range of speeds and altitudes without reference to atmospheric environmental data which is difficult to measure at extreme speeds and altitudes. Four companies were invited to bid: Boeing, Convair, McDonnell-Douglas and Lockheed.

•Newly's Marlinette satellite, lightweight UHF communications package being developed by Fairchild Aerospace Division and intended to extend fleet communications (AWW Mar. 3, p. 15), are expected to be available for launch late this year. Specific launch vehicles have not been assigned.

•Flight tests of innovative wing scores based on research by Bleriot Corp. led by Dr. G. V. Lachman are scheduled to start this week at Britain's College of Aeronautics. Project is being financed by Ministry of Aviation. The wing section is mounted vertically on the fuselage top of an Avro Lancaster bomber.

•Single-crystal photoconductor detectors, which could have application to satellite remote sensing systems, are being developed by Texas Instruments, Inc., for Air Force Systems Command's Space Systems Division.

•Development of small air-cushion vehicle to carry heat-sink detection equipment is planned by Army Transportation Research Command, Ft. Eustis, Va. An initial vehicle is to measure approximately seven feet square and to carry 100-lb payload; it will be attached to conventional land vehicles but will exceed about 22 ft. ahead. Command longer to attract infantry interest, has set a July 26 deadline for interested contractors.

•Folland Aircraft has dropped work on its GERM (ground-effect research machine) (AWW Dec. 30, 1968, p. 51) after Hawker Siddeley board decision that the GERM has no immediate commercial future.

•Modified version of adaptive control system being tested in the North American X-15 is being developed for West Germany's YF-101 VTOL aircraft by Messerschmitt-Bölkow-Blohm.

•Fairchild Aerospace Division is producing dummy sets for application to T-38 CRM in-cabin vehicles.

•Explosible missile designs for application to large liquid-propellant rocket stages are under investigation by Avco-Cosmotec. Study program, under Air Force contract, is to be completed early next year.

•Hawking ER-100 flight research aircraft, originally scheduled by the British to fly at the end of last year, probably will not make the Farnborough display this year. Single-seat airplane, powered by a Bristol Siddeley Orpheus turboprop, is in an advanced stage of construction. Test runs may start in August, but the first flight date has not now been scheduled. Plane was formerly designated Hawking ER-100.



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Washington Roundup

Space Policy Statement

President Kennedy's vague over-report that the Air Force was about to embark on a greatly expanded space program has put the National Armaments and Space Committee and other congressional national space policy on the back burner. The State most was best estimated the status of the military portion of U.S. space effort (AWW June 18, p. 20) but there is a good chance now that it may never even be issued by the White House.

Split between the Air Force and the Defense Department over the military value of large solid-rocket boosters is expected to show itself next month when a special House subcommittee on defense science and technology, which has not been joined on the development of the RS-70 and 200-ton boosters (AWW July 9, p. 17).

Rep. David King of Utah, whose Thordel and Fletcher Powder Co. has solid-rocket facilities, presented Chairman George Miller of the House space committee to hold the hearings. Rep. King, who is running for the Democratic nomination for senator, will charge that the Air Force and National Armaments and Space Administration broke faith with the committee by failing to accelerate large solid-rocket development. An Air Force liaison from DOD developed last year in Defense's research and engineering office questions whether large solids are practical for weapon systems. The hearings are scheduled for Aug. 8 and 9.

Appropriations Status

Budget decisions on a number of aerospace issues will follow the settlement but week of the dispute between the House and Senate appropriations committees. Chairman Albert Thomas of the House Independent Office Appropriations Subcommittee, who represented the House in discussions of procedure with the Senate, predicts that all the major money bills will be sent to the Senate within four weeks. One of these is NASA's fiscal 1963 budget, a bill on which Rep. Thomas is in an uncomfortable position.

Rep. Clarence Cannon, chairman of the full appropriations committee, is pressing Rep. Thomas for cuts in the NASA budget, while on the other side the House space committee (famous for its reluctance to release any money) is pushing to authorize money next year for NASA's Manned Spacecraft Center at Houston, as Thomas' home territory. Appropriations committees can cut but cannot increase amounts authorized by the space committee. Indications are that Rep. Thomas' subcommittee will go ahead and cut about \$40 million from the \$37.9 billion authorized by the space committee.

RS-70 Issue Unresolved

Money was left to be resolved in the Defense Department appropriations bill for fiscal 1963 is funding for the RS-70. President Kennedy asked for \$271 million, the House appropriated \$234 million—most of the money committed for development of ratio for aerospace reconnaissance—and the Senate appropriated the \$481 million asked in the Air Force for full development of an RS-70. Both houses have passed the bill but the House-Senate conference has been delayed until now to the presidential fight. Defense is completing the study it must to please House Armed Services Committee Chairman Gil Voss, who feels the Administration is underestimating the importance of the aircraft.

Perspective may be produced in Senate appropriations subcommittee hearings on Defense Aviation Agency's budget, which also had been delayed by the presidential fight. Chairman Warren Magnuson has been critical of the agency's budget and has been suspicious about its research activities.

French KC-135 Buy

Negotiations between France and the U.S. for French purchase of 10 Boeing KC-135 tankers for refueling MiG-15 bombers reflect a modification of U.S. policies against the creation of separate nuclear deterrent forces by NATO members. Defense Secretary Robert McNamara and last May that he would not object to the sale and Secretary of State Dean Rusk recently has indicated an objection to a separate French deterrent force. He also expressed a hope that France's nuclear forces would be closely integrated with others in the West.

Defense Department's attempts to cut the cost of U.S. dollars overseas by another \$900 million a year should work as assumed positions of U.S. military equipment by allies but it also can increase the defense budget, since the department will buy as much as possible at home rather than abroad. From now on, Secretary McNamara will personally review all proposed purchases abroad to see whether they are in the national interest. He also doubted the differential barrier for foreign firms holding against U.S. firms in military procurement. U.S. firms now can win competition if the cost of hardware transportation and handling of the item is not more than 50% above the cost figure presented to a foreign company.

Maritime Administration planning chief, W. E. Potter apologetically told the House space committee that he could not keep his arms from pointing a finger at the picture of the agency's experimental ground effect airplane (see p. 21). Then he stuck on the screen a picture of the craft nicknamed "Colonel"—a CEM of the ocean. —Washington Staff

Lunar Bug Bids Sought From Eight Firms

Apollo excursion module limited to manned airframe firms; ARES lunar meeting hears design details

Cleveland—Eight aerospace companies will be asked to compete for development and construction of the Apollo lunar excursion module at the U.S. manned lunar landing program's insistence to be approached with critical decisions being made on components, major hardware items and methods of operation. The module is the only major hardware component in the Apollo mission not under contract.

National Aeronautics and Space Administration will request proposals from Boeing, Douglas, General Dynamics/Convair, Grumman, Lear-Terence-Vought, Lockheed, Martin and Northrop for the lunar excursion module (LEM) to be used by two astronauts/scientists for descending to the surface of the moon (see p. 40). Proposal requests were prepared immediately after NASA selected the lunar orbit rendezvous method of landing men on the moon (AW July 2, p. 39; July 9, p. 25, and July 16, p. 20).

Boeing has the LEM in a learned hand during the American Rocket Society lunar mission meeting, which was organized to underscore the various aspects of the lunar program. Technical presentations covered the operational aspects, the role of the functional philosophies dictating the decisions being made as the Apollo program continues.

A number of new Apollo system details were disclosed during the meeting, including the basic characteristics of the LEM, also called the bug.

Because vibration will be light, high-strength surface materials, graphite bimorphs, magnesium and aluminum

applied. Saturn C-5 launch vehicle (AW July 16, p. 32).

By the time the U.S. will behead Soviet Russia in launch vehicles, but that that nation may find in the space race and in the peaceful application of space technology.

He also said that as a result of the 25-day, 500-mile, van crew in the Mercury Atlas-7 flight of Lt. Col. Scott Carpenter (AW June 11, p. 31), a new reference system may be added to the M-3 capsule to be flown by Col. Walter M. Schirra, Col. Carpenter was able to convert his pitch accelerations by time and distance information, but he had an inferior view.

In relating learned and unlearned flight programs, Dr. Joseph F. Shea, Boeing deputy for systems, characteristics and unlearned programs as "walking straight the way" for Apollo mission programs.

Spacecraft design, he said, is dictated primarily by microelectronics and radiation and data as these influences will be released from unlearned flights.

Radiation Belts

Dr. James A. Van Allen of the State University of Iowa, theorized that the triggered portions in the inner Van Allen belt might be disrupted by nuclear explosions, but he cautioned that such a project would require perhaps 100 tons of energy expended in the recent Johnston Island high altitude nuclear tests, and even then there would be no assurance that the area would be safe for extended manned flight.

He theorized that a project to clean out the inner radiation belt would require 10 to 15 years. He noted that the variations made by the Japanese satellite over Johnston Island, where the duration had only a slight effect on the proton belt, easily increased the number of electrons in the lower belt.

Dr. Van Allen, who has questioned the emphasis being given manned lunar flight, said exterior radiation caused by solar events is significant and must be

Astronaut Candidates

Cleveland—Fifty-31 candidates chosen from the 270 applicants for the next group of astronauts will be needed for the planned expansion at the USAF School of Aviation Medicine, Brooks AFB, Tex., and selection of about 10 will be made before the end of August (AW July 25, p. 25).

The group includes some National Aeronautics and Space Administration and Federal Aviation Agency test pilots but most are from USAF and Navy.

Propulsion System

The agency currently prepares a propulsion system using earth-storable energetic propellants. The engine will be bipropellant, with propellant under combustion ranging from 5.1 to 10.2 seconds. Both hot and cold modes are under consideration. Maximum thrust will be 20,000-30,000 lb.

First Apollo manned landing mission will probably result in a lunar stay of no more than 24 hr, according to Dr. Bernard Hedges, director of NASA's Office of Manned Space Flight. Design of the landing module and its technique leaves the star in early flights to about four days. That could be increased as later flights by use of a heavy logistics vehicle (HLV) essentially an unmanned truck containing cryogenics, oxygen, fuel, ammonia tanks and solar cell instruments. NASA anticipates that cables can be established on the moon which will permit astronauts to remain there as long as desired.

On the initial flights, astronauts will carry with them about 200 lb of scientific instruments, Hedges said. National Academy of Sciences and other scientific organizations are advancing NASA in the most promising instruments and experiments.

Backup Method

Keenly similar for the meeting, Dr. Robert C. Semmens, Jr., associate NASA administrator, cautioned that even though the agency has selected the lunar orbit rendezvous mode for Apollo, it is retaining feasibility by going on an study to a backup approach, use of a reusable Apollo-type capsule launched directly to the moon with an

GD, Martin to Study Nova Design

Washington—General Dynamics/Aerospace and The Martin Co. have been selected by National Aeronautics and Space Administration to define preliminary design and systems of the Nova launch vehicle, which NASA has decided will be several times more powerful than its last invention (AW July 16, p. 31).

In an unnamed step, NASA's Marshall Space Flight Center and the two companies are to make "parallel, coordinated studies" of the preliminary Nova design and start preliminary with each other and NASA officials to submit a unified development plan. Participating contractors, which will include limited experimental hardware savings terms, will each be valued at about \$1 million and cover an eight-month period. They are to be named in August.

Of 15 firms invited May 15 to submit proposals, General Dynamics and Martin were among five who responded April 26.

Nova, as now envisioned, is to weigh up to three times the weightlifting capability of Saturn C-5, which will be able to lift 20,000 lb to earth orbit at 240,000 lb.

In other words, Boeing Corp. has been selected by North American Aviation to build the system for lifting space-craft from Earth orbit to geosynchronous temperature and returns both versions of the Apollo spacecraft. Contract will be for less than \$4 million Boeing said.

Wright Aeronautical Corp. has been awarded a subcontract by McDonnell Douglas Corp. to design, develop and test the avionics and engine system for the Gemini two-man spacecraft.

Systems is to provide for safe operation of the launch pad during initial boost phase and after reentry.

listed among other known landmarks. Dr. Shet and better means of protecting other areas must be developed.

Landing Site Selection

U.S. Geological Survey Astrogeology Branch has recommended possible landing sites for Apollo. Dr. Shet said he pointed on the map that all of the bug leaves the initial landing site in a high 10 deg. on either side of the equator

bordered by the 250-deg. and 360-deg. longitude lines.

Such more detailed measurements will precede selection of the precise Apollo landing site, which will be chosen early for its scientific potential. Dr. Shet said. Best landing maps available today have 1:10,000 scale. NASA requires maps to a scale of 1:25,000 over a 10,000 square area with a 10-hr. vertical accuracy and 0.004 horizontal accuracy. At the selected landing site, the agency wants a 1:25,000 scale over 1 km square with 0.5-hr. horizontal and 0.01-hr. vertical accuracy.

Supplementing the lunar maps of operations is obtained for photography, as detailed that it can also to work reliable pictures of half each object 15 ft from the camera, Shet said.

Surface Characteristics

The lunar landing site will be strongly influenced by the surface characteristics which are roughness (see p. 270), slope, dust, temperature and light, surface strength and linkage, and electric magnetic reflectivity in the E, S and C bands.

NASA will look on the Ranger and Surveyor programs to provide this data, and the agency will probably add further Rangers to the ones already at the moon to space that would lead to end of life. Infection was observed by 52.7% of boulders and rocks which were in the boulders on the surface.

During the earlier test at Jezero, a similar boulder was capped when it was rotated too rapidly by explosive pressure. In last week's test, the inflation system was modified to slow this process.

propulsive systems and propellants. The revised Apollo mission will require 15 second maneuvers which will result in changes in velocity amounting to 100-300 ft/sec.

■ Mobility operations, including operation analysis, on-board navigation, ground support and progressive mission expansion. Ground will be in technical command of the spacecraft, the Apollo control center, which will probably be located in the Marshall Spaceflight Center in Huntsville, will be in strategic control.

Groth emphasized that great discipline can be maintained in Apollo demonstrating because of the technical challenges the program faces. Projects, mission operations are remote, and many of the vital instruments must be developed over the season. Dual navigation equipment, operating within the spacecraft, is required. Confidence in the mission depends to a large degree on judgment and these are approximately 90 separate mission modes for the spacecraft. Finally, cross-protection is needed on the later stages.

Marion A. Fager, Groth's assistant director for research and development, said the earth will be used as a relay point between the bug and the Apollo command module because of the fact that the two ends will be in line of sight.

Fager said the Apollo design concept will permit the bug to land at any time of the day or night, and NASA wants to return this flexibility.

He added that the natural light from the earth's shadow will provide the equivalent of a 100 watt bulb at a distance of nine feet.

Zond Intercepts Atlas

Washington—Army Space Zone anti-satellite missile launched from Kirovograd in the mid-Ukraine successfully intercepted the space craft, USAF Atlas, and its launcher from Vandenberg AFB, Calif., 4,500 mi. away, Defense Department said last week. Defense said it had an earlier intercept attempt "was not a complete success." It is department policy not to announce Zond tests until a rocket has been recovered.

Commander-in-Chief Soviet Forces Gen. Klyuchnikov told a group of visiting U.S. congressional delegation in Moscow that Russia has an anti-satellite missile that "can hit a target in space." Russia had claimed and showed a film of the anti-satellite missile in action at a recent diplomatic conference in Moscow. Klyuchnikov said, but denied that it might be misnamed.

Klyuchnikov also told the visitors that high-altitude nuclear explosion was to defense against Soviet intercontinental ballistic missiles.

India Rules Out P.1B Lightning, Widens Search for Strike Fighter

India will extend its search for a supersonic all-weather fighter to Sweden and to South Africa, seeking low-level strike capability that has called out the English Electric P.1B.

Otherwise, the Indians are resolute to maximize the low-level strike capability of Britain's Lockheed F.104. U.S. contractors at least a tacit concession to Pakistan to provide F.104s to India, India says in the middle.

As a way out of the dilemma posed by strong Indian interest, India has shown the Soviet MiG-21. The U.S. had supported selection of first the P.1B, and later the French Dassault Mirage 3, which India also desires.

Possible further complication for the U.S. is a proposed explanation approach by India to the Soviet Defense Ministry for obtaining Mikoyan-Gurevich MiG-21s.

Current flight to England by an Indian air force evaluation team is largely regarded as political window dressing; these men had requested the P.1B after a full evaluation after it was proposed a year ago.

Talks with British Aircraft Corp. are under way to purchase the Bloodhound surface-to-air missile as an interim weapon until India's air force is equipped with a modern fighter. India also is seeking surface-to-surface

missiles once the U.S. refines its plan to sell them.

British concern over the purchase of a Russian fighter has become so intense that Defense Minister George Firth recently came to London with the responsibility to convince the Commonwealth that Britain should enter the European Concorde Market, offered the P.1B to India at a cost of \$70,000, about half the going price. The British government would have subsidized the program, since BAC would have received full price for the aircraft.

British also refused to discuss India's building the aircraft under license. British MiG-21s, now reportedly at least \$125,000 per aircraft, with parts and engine assembly, outside British negotiation.

Reports on India indicate that a prototype fighter had, notwithstanding of the new fighter air frame and engine by British manufacturer, was acceptable to the Soviets.

But British sources feel the Russians may be holding on that point and helping to keep India shopping in the Western market. As a minimal demand, India wants at least an Indian-built jet overhaul facility in a country to build up know-how.

The U.S. might have been the natural choice for P.1B jet overhauls when the MiG-21 situation arose. The U.S. proposed as an alternative that India buy the Lockheed C-110 from Lockheed-Marietta, and that the U.S. in turn would ask the British to establish a F.104 production line in India with the U.S. guaranteeing the British against jet loss. A similar proposal was made substituting the Mirage 3 though both can be used to U.S. policies to reduce its political risk.

India's first jet fighter program began when it found itself without an engine for the Hawker Siddeley HF-24, designed by Dr. Kurt Tank as an all Indian venture.

The fighter was scheduled to be the Bristol Siddeley Orpheus 12, reengined at 13,700 lb-thr, thrust with afterburner and loads had been 35 of them in India recently by hand.

Bristol Siddeley was willing to put another \$1 million into development of the engine, also should putting in \$7 million of its own resources. Another \$10 million was to be invested in company development by India, and the British government to sponsor development of the engine for a national carrier. An offer by Britain to compensate in offering India a loan for the general purpose

of aviation development and not publicly specifying the Orpheus project as beneficiary was rejected by India's Defense Ministry, Kishore Mehta.

Engines development had been started with U.S. military defense funds, but these were cut off when Mehta first approached Russia to buy MiG-17 engines and MiG-17 interceptors.

India then turned to Britain for an engine, and the Orpheus and two Hawk V/600s were obtained for evaluation and are still on board test at Bharatavia Aircraft. The V/607, so the same power class as the Orpheus 12, cannot be fitted easily to the HF-24 airframe without major changes.

India thus began looking at the Russian RD-9 engine, identified in India as a replacement of the MiG-21, and when India showed interest the Russians proposed the whole engine-airframe package deal. Indian air force interest is reportedly being impressed by the MiG-21 performance and as "the most spacious machine demanded by Indian conditions."

Scallop from the 4,000-lb-thr class of the V/6-21 centrifugal flow engine to the RD-9 axial flow powerplant with small frontal area might have retarded a major ordering of the HF-24, converting it from a two- to a single-engine aircraft. Thrust for the MiG-21 engine previously has been reported at 22,200 lb.

Renegotiation Change Effects Are Debated

Washington—Practical effect of a new and adverse to renegotiation law, completely subverts a critical source of U.S. tax Court decision by the U.S. Court of Appeals is being debated among legal and tax experts.

The amendment, titled onto legislation extending the law two years to from 1980, 1981, was widely applauded in the aerospace industry as assuring companies to the first time of the appeal right.

Taking issue with this position, Sen. Paul Douglas (D-Ill.), a member of Senate Finance committee, maintains that the amendment needlessly confuses existing law as defined by the Supreme Court at the 1975 California Eastern Line case. In that case, interpreted by Douglas, the Supreme Court ruled that the scope of review of renegotiation decisions is fixed by the same provision of the Internal Revenue Code that defines the scope for the review of tax decisions.

The equal appellate treatment for tax and renegotiation cases is the theory of most economists. It holds that appellate review of tax cases or reviewing the decision of the Tax Court on questions of law and reviewing the case to the Tax Court for further action.

French Rocket Site

Four-Fifths government plan to start construction on a \$400-million rocket-launching station on the Atlantic coast about 30 km southwest of Bordeaux.

French hope to have this site operating by the end of 1984, according to a Defense Ministry spokesman. About 3,500 people will be employed at the rocket facility.

Site selected in the Landes Department station 15 km, along the Atlantic Ocean between the islands of Bassin and Mimizan. It extends back from the ocean 4 km.

Launch sites will be the chief French rocket-launching sites but the first in metropolitan France. Under the Espace Agreement made with the Algerian provisional government, the French are one time to have their sites east range of the Casablanca until 1987. But the French do not want to be caught short if the Algerians will not let them stay after that.

Second existing system, on the Re Re coast in the Mediterranean, does not have adequate range for the number of French plans to develop.

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DH-125 Executive Jet Transport Rolls Out

First photo of the de Havilland DH-125 executive jet transport, which rolled out July 21 at Hatfield, England, shows aircraft as virtual twin aircraft over a angled dolly of press T-tail. Engine test of the two Bristol Siddeley Viper 20 turboprop engines, which will make first flight with the DH-125, will start the week. Maiden flight will be in mid-August. For other details see p. 46.

X-15, Soviet Fighter Claim New Records

United States claimed a new world altitude record for manned aircraft last week with the No. X-15 research vehicle, but at the same time probably lost the world speed record to the Soviet Union.

USAF Maj. Robert M. White flew the X-15 to 354,200 ft to 10:00 a.m. on July 1, exceeding the record set by Soviet Maj. Valery Chkalov in 1960. X-15 moved to 26,000 ft.

The X-15 was launched over Edwards AFB, Calif., and it took a single-stage attitude to altitude from 2,000 to 11,000 mph in 51 sec.

An Air Force and White would conduct instrument wing for the altitude record flight. Eligible, requirements state that the wings were intended to survive at flight higher than 264,000 ft.

White's mark of 310,000 ft, or approximately 79 km, is only about 3 km short of the upper limit of 62 km which FAI recognizes for manned aircraft flight. Above that point, it is considered

Test Failure

One of four high-altitude balloon flights planned by National Aeronautics and Space Administration to study the effect of cosmic rays on aircraft was only partially successful because failure of a life support system caused the death of three crew members and four others being used as subjects.

Another attempt on the balloon crew a group of young Boeing flight test engineers probably is the last chance to observe the upper air zone being studied at the University of California.

The 300-ft-dia. helium-filled balloon, designed to reach 120,000 ft, actually reached 114,000 ft. High winds net the planned 35 hr to 95 hr during which the balloon traveled 1,800 mi across Gosses Bluff, Australia, to Prince Albert Station.

Altitude was controlled from an Avco Computer landing place. Budgeted data was stored on a 14-channel tape recorder.

spur flight, so breaking White's record will entail the difficult job of letting nothing but air in when his standard and below the FAI space flight record. U.S. also plans to use X-15 to reacquire the world aircraft speed record. The vehicle will be the same as the X-15, modified to about 100 mph to 15,000 ft, and it will be used to single-stage attitude to altitude from 2,000 to 11,000 mph in 51 sec.

An Air Force and White would conduct instrument wing for the altitude record flight. Eligible, requirements state that the wings were intended to survive at flight higher than 264,000 ft.

White's flight over the 15,250 km course reached a maximum speed of about 1,060 mph during one leg.

Average altitude throughout the Russian officer's flight was 80,000 ft. White also beat the FAI record for the highest altitude flight, which is 111,000 ft, with a record date to FAI claimed by the R-600A, a delta wing monoplane powered by a T-008 ML-70F turboprop engine developing 15,200 lb thrust and a GRD-12 rocket engine rated at 6,000 lb thrust. The R-600 probably is the MiG-19.

FAI is expected to confirm White's flight to 264,000 ft and then Maj. White's 111,000 ft as well.

In another record close, the Soviet MiG-21 fighter-bomber has surprised two international balloonists distance records now held by the USSR's MiG.

The July 5, Capt. Glebko R. Rostov flew an Ilyushin IL-76 900 mts from ESS AFB, Ogulin, to a small field near Springfield, Mo. USAF is claiming this as a nonstop straight-line distance record, exceeding the existing mark of 761,007 mts as set Sept. 21, 1980, by a Soviet MiG-21.

On July 5, Capt. Richard H. Conn flew a Hawker Siddeley Viper 20 over a closed course near Moers Lake, Calif., establishing a claim to the closed course distance record held by an MiG-1 which flew 625,964 mts on June 24, 1980.

Army Picks de Havilland STOL Transport

Washington—Army has chosen de Havilland Aircraft of Canada, Ltd. to develop a 5-ton payload, short-takeoff-and-landing (STOL) aircraft transport, but had not selected the turboprop powerplant by last year. The aircraft will be called the Caribou 2.

Army originally wanted a larger version of the twin piston-engine de Havilland AC-1 Caribou for the STOL mission, but contractor complaints to Congress forced a competition (AW, June 18, p. 30). Industry sources, including some of the bidders, expressed no surprise at Army's choice.

First test models will be built at an estimated cost of \$71 million. Army studies show the aircraft will cost about \$7 million. General contractor proposals by both the Canadians given out and de Havilland are undivided to have played the key role in the Army's decision. Other factors included Army's operational experience with the AC-1 and the fact that a Caribou test-flew for approximately a year with General Electric T64 turboprop engines, which de Havilland proposed—and pushed—for the Caribou 2. Bidlets were allowed to specify a choice of engines, but they had to submit a close look at the T64 before the final development effort got under way.

Three other engines have been given varying degrees of consideration as possible powerplants for the STOL transport. They are Rolls Royce Dart, the existing T55 and Allison T56. The T56 is considered large enough that it would require almost a new carbon fiberframe design, which would soon be more expensive. The T55, while it offers more advantage over the T64, is not as fuel efficient as the T64, and its specific fuel requirements exceed.

Rolls-Royce is understood to have joined Defense Department and Army that Dart engines would be built in Canada if there were sufficient justifications for it. The compressor eventually will be located in aftfuselage and engines built in North America. Whether Rolls-Royce would consider four Dart engines, plus a possible air compressor and fuel production, as sufficient justification for Canadian manufacture is not known.

Another interesting factor in the engine power race is that Preston attempts to "fix" Army's "short" range of domestic haulage, transportation and handling is not more than 10% above the cost of long-haul haulage.

The Caribou 2 will be able to accommodate such loads as the Pavehanger mine system, 105-mm howitzer and three-quarter ton truck—the same cargo compartment capability as the Army

Ventral Chassis HC-1B cargo lifter.

The Caribou 2 will permit an increasing contract in approaches when it is ready for flight late in 1984—although Army is understood to have a 10-ton payload requirement. Defense restrictions on what Army can purchase directly probably mean that Air Force would handle direct development of such an aircraft.

The Caribou 2 will be an extension of an existing, comparatively conventional short-haul aircraft, while the forthcoming XC-142 will be a technically more ambitious attempt to get vertical liftoff characteristics into a mobile cargo aircraft. If the XC-142, which is to be powered by the GE T64, should develop rapidly enough it might even supersede the Caribou 2 as the preferred transport aircraft. The Vought-Ryan-Hiller team, a team the former rejected proposal, has proposed a follow-on version of this same aircraft in the competition.

Another rejected proposal that could still reach development under Air Force sponsorship for such missions as supply

of troops in Vietnam is a modification of the two-seater USAF Fairchild C-123 that would have grossed increased to 10,000 pounds and an 1,000-lb cargo field. Although Army is understood to have a 10-ton payload requirement, Defense restrictions on what Army can purchase directly probably mean that Air Force would handle direct development of such an aircraft.

The modified C-123—which actually won Fairchild's primary proposal although the company also offered a modified F-27—would use four GE T64 engines, double slanted flaps, a short-sweep aileron and spoiler system and have increased chord in the horizontal stabilizer to compensate for the slanted flap arrangement. The change would require substantial changes to the present C-123. The modifications necessary would have been less than those required to fit the F-27 to the Army STOL mission.

The version of the C-123 could carry 1,300 lb over 900 miles, spending 10 and not 1,000-hr fields, or carry 3,800 lb over 1,700 mi—for example from Clark Field. The Philippines in Vietnam still using rough fields of no more than 1,000 ft. It would use the same high-power engines, plus landing gear modified as C-173B, originally developed at McDonnell Douglas' Hampton, Md., plant under a Photo-1000 USAF contract to see whether the aircraft can be used in low-level.

The aircraft, called a C-123B, is scheduled for rollout Aug. 1, flight testing from Aug. 15-15, and delivery to USAF at Eglin AFB, Fla., on Sept. 1 for evaluation there. Two GE T64-101-ge engines, rated at 3,500 lb in these cells, are being suspended from prose boards of the present two Pratt & Whitney T53 turboprop engines to provide the extra power required for short, unprepared fields. Other modifications include evaluation of aerodynamics and landing gear design in the fuselage.

Modification to the landing gear will use a previously-developed design with a 210-in. track width, compared with the usual 144 in. width, to improve stability on rough ground. Tires will use about half the current pressure.

The C-123B requires an average landing distance of 1,480 ft when landing over a 50-ft obstacle, a soft field of a 73,000-lb gross weight. Normal takeoff distance is 42,000 ft, a 1,700 ft.

The STOL modification would operate from 1,000 ft of landing distance, a maximum takeoff weight of 67,000 lb, which is 7,000 lb above the normal. Maximum gross landing weight will be raised from 54,000 to 62,000 lb. Unloaded range must be 1,000 miles with a 21,000-lb payload.

Telstar Transmits Color Television

Color television pictures of a still photograph was successfully transmitted via Telstar between Janus and Andover, Calif., last week as the Bell System active communications satellite continued to perform perfectly (AW, July 16, p. 23).

The first orbital photo transmission attempted during the 55th orbit produced a solid red picture. On the next two orbits were received with full fidelity.

First transmission of color television between the two stations between U.S. and the Soviet Union was at about 7 p.m. (EDT) when a press conference will be held in European television stations as President Kennedy's press conference will be relayed to European television stations via Moscow. The press conference will include a comment by the Moscow television chief at Moscow Radiohead, S. D. Gorbachev, and Theodore Roosevelt.

On the next orbit, the European Broadcasting Union is scheduled to transmit to U.S. television networks live scenes of the Soviet Union as the Vostok the Change Electron in Paris, a Mar. 20 launch operating in Germany and Russia in the Arctic.

On July 26, officials in 25 U.S. cities will carry on two-way conversations via Telstar with their counterparts in 25 European cities. Although the communications satellite has the bandwidth necessary to handle 600 simultaneous phone conversations, multiple equipment problems resulted at the Andover ground station last week, causing a number of simultaneous interruptions to 15.

The only problem reported during the first eight days of Telstar operation was the difficulty encountered during the 21st and 24th orbits by a few of the National Aerospace and Defense Organization's remote station stations at getting the antenna to expand to its optimum position when Telstar was at extreme angles. The problem was not encountered by Andover or other major stations, and was resolved on the 25th orbit, according to Bell Systems spokesman.

Telstar Falls to Sway Comsat Bill Opponents

Washington—American Telephone & Telegraph's (AT&T) successful Telstar experiment has apparently left unassisted the group of senators determined to block legislation establishing a privately-financed corporation to operate the U.S. segment of a world wide communications satellite system.

The excellent performance of the AT&T satellite, the first communications satellite (see box, above) brought a new set of demands for Senate passage from sponsors of the measure. But the majority group of senators, fearing that the proposed corporation could be dominated by AT&T, showed no sign of stirring from its plan to block action through a filibuster (AW, June 25, p. 29).

The legislation, recommended by the Administration, has already passed the House 314 to 9 and been approved by the Senate's communications committee. Sen. Ervin G. "Ernie" Gruening, a Democrat from Alaska, has introduced a bill to give the Hinsdale C-144-VTOL side-by-side fighters and production at Hinsdale and possible Sen. John C. Stennis, another Democrat from Mississippi, has introduced a bill to amend the Senate's bill to re-allow the Telstar corporation to provide for the STOL competition, as proposed by the Senate's communications committee.

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Pressing for quick Senate action, Sen. Robert Kasten (D-Ola.), chairman of the space committee, told Senate Wreck that the Telstar satellite "will have an irreparable effect on the outcome of the legislation." We'll play it by the book, he said.

Government also will support the new version of the bill, he said.

News Digest

USAF Thunderbirds aerial demonstration team will fly a flight in Republic F-105 Thunderchief jet aircraft beginning next year. The team is presently flying North American F-100 jets.

Convair 440, an in-flight-camera aircraft development aircraft made its first flight at Wichita, Kan., July 15. Aircraft is in the 5,000-lb plus class, with 550-hp turbocharged Pratt & Whitney R-1830-48 engines. The aircraft is to begin flight testing in August.

Joint Navy-nasal telescope under construction at Space Center, W. Va., was canceled last week by Defense Secretary Robert S. McNamara. Unfinished sections in science and technology, he said, had proved better results of accomplishing the telescope's objectives without research in photo-spheric physics, space communications, navigation and missile defense. In addition, increased cost of the project has risen from \$50 million to nearly \$200 million.

Werhfeld, SKN-2, flew over 100 July 5, p. 50 will carry an experimental passenger service in August between the Isle of Wight and Southampton, England. Viasat, A. S. Haworth began service in Wales last week, in competition with British United Airways.

Gen. Josef Kampfner, chief of the West German air force since the formal acceptance in 1955, will step down this summer to be replaced by Gen. Werner Prantl, who also has played a major role in re-building the Luftwaffe to its present strength.

Allied Airlines is converting its 12 Convair 540 turboprops to AW-240 post-turboprop aircraft (AW, Aug. 6, p. 50). Berlin Aviation of Washington, D. C., will modify the aircraft, replacing the Napier Elan post-turboprop with Pratt & Whitney CT-16 piston engines. Contracts for conversion of the others are under negotiation.

Dr. Jerome B. Wiesner, President Kennedy's scientific advisor, has been dismissed without debate by the Senate last week as director of newly created Office of Science and Technology.

American Airlines has reported a net profit of \$3.2 billion for the first half of this year, compared with \$2.5 billion for the same 1966 period. Total revenues of the airline were \$219.8 million, for a gain of \$27 million over the first half of last year.

Douglas Labor Pact

Los Angeles—Substantial progress is being made in labor negotiations with Douglas Aircraft Co. Inc. and the first contract between the two is likely to come in early September.

Douglas' plan and facilities will be "agency shaped" in which all employees in the incoming unit will pay the same the equivalent of dues whether or not they join the union.

Douglas agrees to negotiate on simple annual membership benefits (SMB) in 30 months and will immediately begin a fund to save future SMB payments at the rate of one cent per hour.

There will be pay raises of five to eight cents per hour in the first year of the contract, six to eight cents per hour in the second year, and six to eight cents per hour in the third year.

Cost-of-living clause is the same as the existing contracts will be retained.

Douglas considers the contract from state—naming wages and fringe benefits—than 24 cents an hour over the three year period. Douglas' union, postulating a compensation plan of 100% of the company's total payroll of 67,000 lb, which is 7,000 lb above the normal. Maximum gross landing weight will be raised from 54,000 to 62,000 lb. Unloaded range must be 1,000 miles with a 21,000-lb payload.



NEW YORK AIRWAYS VERTOL 100 miles to west following forced landing in New York Harbor. Legended about from broken down radio transmission gives 100 miles total distance of non-stop and power loss on the other. Restraints power enabled the pilot to tax toward N.Y.C. Wall Street helipad, 11 mi from landing point. Smoke is from burning oil, which leaked into condensate after reported jet water system loss of heating.



HELICOPTER CONTINUES TAKE (above) with one power plus a tow line was attached at right-angle to initial engine failure, which would have normally stopped the lift. Rotors were stopped (below) as the helicopter was forced the last few yards to the dock. Lift capacity is slightly low in the water, but landing due to the weight of an full fuel cell. The engine was run at the eight spinners until it started again. Some wire had passed through an electrical component, though across deck while the lift gondola and side into the rear baggage compartment, which was not fully watertight. Numerous passengers and three crew members suffered no injuries, and were evacuated after the helicopter was hoisted.



Ingestion Causes V-107 Water Landing

By James E. Addcock

New York—Mishap of both eyes, resulting from ingestion of glass fiber, soot and woodpreserving insulation which broke out from the furnace when insulation touching coated wire, caused blinding July 15 of a New York Arrow Verst 107 telegrapher at New York Huber.

No injuries resulted among the 14 passengers and three crew members aboard. The aircraft floated on its suspended hull almost 24 hr., and was towed 14 mi. under motor power.

No. 1 starboard engine stopped completely when a plastic-covered

acket of glass fiber wool-type sound proofing insulation, measuring 10 x 14 in. and 1 in. thick, dropped the air inside No. 2 was reduced to between 75.8% power after insulating glass fiber glass. The Ventil is powered by two General Electric CT5H-110 twelve ampere units at 1,750 rpm each.

The ingested material came from a maintenance dock on the burned solar transmission system, 29 ft directly west of the engine intake. The dock, of plain block construction, is part of the

ption's advantage being when closed, and is a non-slippery platform when open. The glass fiber safety toe on the don's left side and the sandal-

not blew out after the door case fell out in flight.

Investigation by the insurance agent who owned the door to open. A New York Attorney offered and that a 100-kg object was have struck the panel object as there was a dent located on the door. Testing of the panel and subsequent release of the insulation by growth resulted from displacement and vibration. Civil Aerodynamics Board of Canada and they had no opinion yet in case of the door opening.

"So far as the post-accident situation is self is concerned, the pilot handled it very well," a CAB investigator said.

A post-examination revealed no evident damage to the stalled engine, the insulation packet having stopped just inside the air intake. Compressor blade damage was evident on No. 2 engine, and later inspection was expected to reveal further damage in view of the engine's power loss during flight. Parts of the glass fiber tubing were found in No. 2, indicating heavy ingestion.

bearings after salt water was sucked in following the landing. Burn blue smoke emitted during test as oil from the cracked bearings leaked into the combustion section.

From Newark, Airport to Wall Street, the stop on its flight to LaGuardia and Newark. The Newark/Wall Street leg, long, usually takes 4 min.

Cape Cod, King 45 was preparing to make a refueling at Robert Burns, the cockpit fuel at 600 ft. This time, a ground crew hoisted a 100 ft. crane alongside where the No. 1 engine gear sleighs in flaps served the purpose, of黎斯島上的一處停泊處。

Verifying that there was no fire, King and Brown attempted an *in-rush*. The auto started but would not accelerate above 15 mph, or 45% of top gear for speed. They never did get off the No. 2.

King at first considered trading on Barth Island, one of the state's last unlogged tree-ripened virgin timberlands on the ground. He altered course for nearby Governor's Island, an area with timber a lair deer field but the helicopter continued toward the pine under its own power. The low fuel was a precursor against complete failure of the No. 2 engine, which would have left the aircraft unable to haul tales. King shot down pine trees

"We seemed to pick up the ground vibration effect as we neared the water, so we were able to hold altitude for a while," King said. "We were getting about 50% power out of the remaining engine." But then the engine started chugging again.

Brother and we lost control. It was out of control and we couldn't chart the Governor's Island new wall."

King outlined the passengers at the suspending water leveling. They set themselves down at Botterswick Channel, opposite Governor's Island, New York. The landing made with

Merger Plans
Washington Motor planning to be sold along at the proposed merger price.

Message Plans

Washington-Maga planning for the formalizing of the proposed merger between Pan American World Airways and Trans World Airlines with the Civil Aviation Board has been completed.

During recent weeks Fan has been including President Juan T. Tuazon, Vice President Samuel F. Zyndman, assistant heads of all federal agencies and departments which might be armed with the merger, including Attorney General's office. Fan plans to test top government action plan and to research the way for its possible execution in the CAR.

The response prompted Pao An to make a deal with the proposed combine, although top Administration officials are not granting the plan any official blessing until all moves have been made in public CAC hearings.

AIRLINE OBSERVER

► Negotiations are under way for acquisition of four Canadian CL-44 turboprop cargo aircraft by Lufthansa. West German government is participating, as it may finance a major part of the purchase and lease the aircraft to Lufthansa. Canadian is also close to agreement with BOAC for two CL-44s initially, and a larger number later (AW June 16, p. 39). Major factor in the continuing interest in CL-44s is that the Canadian government is incurring up to 80% of long extended purchases of the aircraft.

► At least one foreign flag carrier is currently re-evaluating job requirements of ticket agents. In addition to selling tickets, a complicated procedure by itself, agents of international carriers must be equipped to provide overseas travelers with information about political, economic and social conditions they will encounter in foreign countries.

► Transport Workers Union settlement with American Airlines centers on a new type of job security issue within the airline industry. TWU, which called off a thousand-day strike by 30,000 members after appointment of a presidential emergency board, claims that the union has been subcontracting TWU fast service personnel for union stations at host stations in at least four major cities and planned to spread this practice to most of the carrier's system. Mechanics feel that threatens their jobs. TWU members were still studying the settlement last week.

► Federal Aviation Agency this week will conclude within the government a 751-page report containing a proposed implementation program for Project Gemini recommendations, to obtain both FAA and Defense Department consensus prior to public release. The report was prepared by FAA's systems design team (AW Mar. 29, p. 48), headed by Albert Brown, after nearly a year's study. The plan, in accordance with original Gemini recommendations, does not propose to make widespread use of SAGE computers, which may draw some fire from the Air Force.

► Industry proposals for an airline interline reservation system, a revolving computer center to interconnect individual airline reservation computers (AW Aug. 18, p. 45), were due late last week. Companies invited to submit proposals to the Air Transport Assn. include Collins Radio, Ferranti-HiPAC, International Business Machines Corp., ITT Federal Laboratories, Radio Corp. of America, Raytheon Rand Union, and Teletype Corp.

► American-ANA Chairman R. M. Attett will visit Britain, The Netherlands and U.S. to study short-haul transport markets. Attett recently is chiefly interested in the Boeing 727 and the BAC 111 and will also look at the Fokker F-28 small jet transport as a possible replacement for the Vickers Viscount. Under Australia's Airlines Re-enforcement Act of 1968, the country's two airlines, Attett and Trans Australian Airlines, cannot place orders for new aircraft before next November (AW Nov. 11, p. 46).

► British Ministry of Aviation will tighten regulations covering strength losses of older aircraft, such as the Douglas DC-3, Heron and the Viking, which are operated by British independent airlines. Parliamentary Secretary Christopher Woodhouse stressed that the move may involve "economic penalties," and emphasized that the airways, although safe, do not measure up in all respects to International Civil Aviation Organization standards applied to all new aircraft produced since 1951. Particular stress will be placed on structural equipment and engine-unit performances.

► Key concerns among purchasers of the Boeing 727 over new versions are the airplane's reliability and maintainability of the aircraft's complex flap and leading-edge flap arrangement. Operation in winter-time may also be viewed as potential problem, although Boeing has included design and structural strength features specifically aimed at the slush threat.

SHORTLINES

► Alitalia Airlines reported a 50% increase in enroute transatlantic passenger during the first six months of the year. Passengers totalled 283,356. June was a record month, with 104,610 passengers representing a 59% increase over the same month last year. June load factor was 85%, compared with 68% in June, 1961.

► German Air Lines credits a stepped-up advertising and promotion program for its 27.4% gain in revenue passenger miles during the past six months over the hot half of 1961.

► British United Airways said it will inaugurate trial service across the Benelux with its Vickers VAS 3 Heron on July 20. Round-trip fare will be \$5.30. Costs during the eight-week period will be shared by BUA, Vickers-Armstrongs and British Petroleum.

► Central Airlines says its 20,239 passenger bookings in June represented a 13.5% increase over June, 1961, but 600 less than May's record high.

► Continental Air Lines has ordered its fifth Boeing 727. The airplane is slated for delivery in May, 1963.

► Ethiopia Airlines has gained Spanish government approval to serve Madrid from Accra and Athens. The new service is expected to begin this fall with Boeing 720B turboprop aircraft, making Madrid a gateway to the Middle East and East and West Africa.

► Federal Aviation Agency, electric June 13, granted Trans World Airlines a 2,200-k. m. time between overheat for the General Electric CJ-853-3 turbofan engine that powers TWA's Convair 880. This is highest allowable TBO to date for this engine in airline service.

► Local service airlines reported a 17.16 increase in revenue passenger miles during the first six months of 1962, compared with 1961. Total traffic from San Diego, Iowa, showed 17% over June, 1961. Load factor for the year's first half was 42.1%, compared with 41.4% in the same 1961 period. Load factor for June, 1962, was 44.7%, slightly over the June, 1961, mark of 44.5%.

► United Air Lines said 82.4% of its regular customers in impose in a cost-cutting measure, indicated they agreed with U.S. policy against the sale of liquor in jet route accommodations. Of the remaining, 12.1% took the option view and 4.6% took no position.



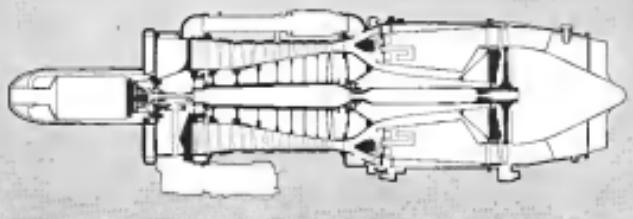
Look quick! That's TWA's new StarStream jet!

The dependable, fast-moving TWA StarStream® is the nation's newest transcontinental jet. Its four DynaFan® jet engines generate more power than any engines in use by any other airline flying across the U.S.A. In First Class you'll enjoy the new StarStream Royal Ambassador service, gourmet dining patterned on TWA's famous European service. Whether you fly First Class or thrifty Coach, you're always TWA's guest at mealtime.



*StarStream and DynaFan are service marks used exclusively by Trans World Airlines, Inc.

New Viper provides reliable, low-cost power for executive jets



The Bristol Siddeley Viper 20 is now at an advanced stage of development for the next generation of light executive transports. This new version is basically a Viper 1F with a "zero" stage added to the compressor which gives a 30% increase in mass flow, a reduced turbine entry temperature and an improved specific fuel consumption. Like all its predecessors, the Viper 20 retains the basic design concepts of a simple, reliable engine with high thrust at high altitude and low fuel cost.



SELECTED FOR TWO NEW EXECUTIVE JETS
The Viper 20 has already been selected as the power unit for both the D. H. Rievaulx 155 and the Fugitive/Douglas 808 "Viper Jet" executive jet aircraft.

PROVEN POWER

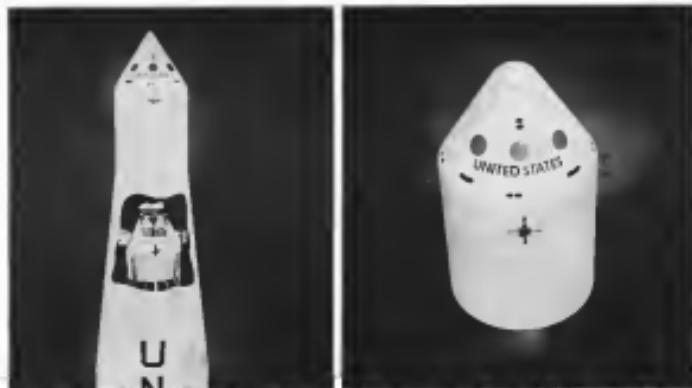
Starting from 1,640 to 3,000-lb. thrust, the Viper series of turbines has now been flying for over 8 years and has proved itself under a wide variety of maximum operational conditions. Over 1,000 engines have been ordered and Vipers currently power three aircraft types in service—Hawker Jet Provost, Messier MB 328 and Jindivik target drone.

BRISTOL SIDDELEY ENGINES LIMITED

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SUBSIDIARY COMPANIES: BRISTOL SIDDELEY MARINE, BRISTOL SIDDELEY MARINE SYSTEMS, MARINE, LTD.
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Airline Traffic—May, 1962

	Revenue Passenger Mileage Mile (1000)	Revenue Passenger Mileage Mile (1000)	Passenger Load Factor %	# 1 Mile Passenger Mile (1000)	Revenue Passenger Mileage Mile (1000)	Flight Time-Miles	Total Revenue Passenger Mileage Mile (1000)	Overall Revenue Load Factor %
DOMESTIC TRAVEL								
Aeromexico	693,347	140,511	48.8	7,172	115	7,344,261	12,193,549	48.7%
Airline	896,476	159,497	48.7	7,159	115	8,041,426	12,193,744	48.7%
Continental	588,929	99,382	47.8	7,202	113	6,777,326	12,193,811	48.7%
Delta	326,616	567,364	48.2	908,471	421	6,149,212	12,193,823	49.3%
Eastern	750,497	152,474	48.7	7,159	115	7,504,594	12,193,829	48.7%
Frontier	122,000	12,000	48.0	1,000	115	136,000	12,193,830	47.7%
Midwest	154,410	48,248	48.8	1,182	115	215,329	12,193,837	48.4%
Northwest	181,550	116,536	49.8	7,168	115	201,589	12,193,838	50.4%
Twa World	684,877	125,721	48.9	7,146	109	7,263,114	12,193,841	48.9%
United	942,424	166,624	48.7	8,250	115	10,000,000	12,193,844	48.7%
Western	164,314	55,431	48.8	106,429	115	2,027	12,193,845	41.3%
INTERCONTINENTAL								
Aeroflot	8,240	8,233	48.7	7,409	500	332,841	12,193,850	48.8%
Aerofrance	7,316	11,103	48.7	40,616	500	1,489,546	12,193,852	48.7%
Caribbean Airlines	43,496	2,203	48.2	2,942	500	125,148	12,193,853	48.2%
Delta Air Lines	1,311,121	121,121	48.7	10,116	500	32,331	12,193,854	48.2%
Eastern	46,279	44,279	48.5	1,070,118	500	499,214	12,193,856	48.1%
Eastern	8,205	1,297	48.7	192	500	5,051	12,193,856	48.0%
Frontier	23,477	48,100	49.5	3,923,239	500	473	12,193,858	21.7%
Pan American	1,247	6,108	48.7	46,312	500	2,024	12,193,859	48.1%
Aeroflot	102,316	240,616	48.7	3,026,416	500	1,316,270	12,193,862	48.1%
Latin American	93,419	191,508	50.7	6,654,654	500	13,176,650	12,193,866	48.2%
Peoples	23,212	23,212	48.7	4,222,212	500	1,056,212	12,193,867	48.2%
Peru	50,116	74,479	48.8	78,762	500	626,726	12,193,869	48.1%
South Africa	115	149	50.5	8,715	500	5,849	12,193,870	21.9%
Twa Caribbean	11,452	18,112	48.5	2,322,381	500	342,210	12,193,872	48.8%
Trans World	20,221	32,021	48.7	2,322,381	500	342,210	12,193,873	48.7%
United	14,408	34,166	48.4	397,340	500	214,264	12,193,874	48.7%
Western	7,045	10,128	48.7	16,254	500	319,179	12,193,875	48.7%
INT'L. AIRLINES								
Aeroflot	10,760	14,911	41.6	16,370	47,440	70,731	12,193,876	41.9%
Brussels	36,219	8,708	50.6	8,612	3,120	19,952	12,193,877	51.1%
Caravelle	26,912	4,764	48.7	20,412	3,120	22,100	12,193,878	49.8%
Continental	25,212	21,212	48.7	12,156	3,120	31,469	12,193,881	49.8%
Latin Control	27,770	4,299	37.8	11,816	31,017	75,334	12,193,882	48.8%
Malta	98,424	18,114	48.5	26,278	31,120	14,732	12,193,883	48.5%
North Central	98,424	18,114	48.5	26,278	31,120	14,732	12,193,884	48.5%
South	32,720	55,607	48.8	21,256	31,120	81,164	12,193,885	48.1%
Swiss	68,101	9,203	48.5	18,132	31,120	12,771	12,193,887	49.5%
Transocean	58,044	10,534	48.7	17,341	31,120	20,211	12,193,888	48.7%
Transocean	49,700	7,700	48.7	9,951	31,120	12,121	12,193,889	48.7%
Trans Texas	23,209	7,174	48.7	20,456	31,120	64,339	12,193,890	48.8%
West Coast	34,140	8,123	48.8	18,110	31,120	37,079	12,193,891	48.7%
PARASITE LINERS								
Airforce	39,269	6,323	48.7	4,147	2,318	337,703	12,193,892	48.7%
Marconi	34,751	8,267	48.7	4,000	2,318	337,703	12,193,893	48.7%
CARGO LINERS								
Aeroflot East America	3,120	18,222	70.4	34,274	31,021	101,370	12,193,895	48.8%
Flying Tiger	1,107	4,107	48.7	12,184	31,021	33,184,279	12,193,896	48.8%
Rediffusion	1,107	4,107	48.7	12,184	31,021	33,184,279	12,193,897	48.8%
Transocean	9,263	56,690	70.5	16,352	294	7,472,311	12,193,898	48.7%
Scandinavian	2,702	8,210	70.7	1,329,651	294	6,375,344	12,193,899	48.7%
Sikorsky	1,267	8,322	70.2	1,267	294	8,774,970	12,193,901	48.5%
HELICOPTER LINERS								
Magirus Helikopter	7,710	168	50.7	272	239	16,186	12,193,902	49.8%
Los Angeles	1,040	2,022	48.8	1,707	2,284	2,363	12,193,903	48.8%
New York	14,509	555	50.7	863	2,284	33,709	12,193,904	48.8%
ALASKA LINERS								
Alaska Airlines	9,200	7,425	48.8	64,106	1,455	1,100,386	12,193,905	48.8%
Alaska General-IGA	11,149	807	48.7	6,875	1,455	91,339	12,193,906	48.7%
Caravelle	2,760	257	48.2	2,174	48,411	91,481	12,193,907	48.4%
Rediffusion	1,119	47	48.7	548	749	4,103	12,193,908	48.9%
Transocean	2,760	257	48.2	2,174	48,411	91,481	12,193,909	48.4%
Transocean	10,167	12,620	48.4	144,703	4,129	323,164	12,193,910	48.7%
Transocean	1,373	1,371	48.3	70,101	2,174	74,111	12,193,912	48.3%
Western Airlines	720	24	48.7	899	2,174	2,844	12,193,913	48.7%
Western Alaska	5,969	1,244	48.2	65,205	2,174	201,722	12,193,914	48.2%
Aviation	10,154	491	50.7	5,536	579	44,461	12,193,915	52.2%



TWO-MAN lunar excursion vehicle is seen in the assembly model (left) between the S-IB third stage of the Saturn C-5 booster and the Apollo command and service module with its aeroshell. Although the model shows two lobes fitting in the "boot," they would not meet if module would really be descent to the lunar surface. At right is a model of the Apollo spacecraft with its aeroshell removed.

Lunar Orbital Rendezvous Poses Biggest

By David B. Hoffman

Washington — Technical challenges posed by lunar orbit rendezvous deserve the already significant achievements of the 4-19 months of work on the project.

Plans to employ the technique for Project Apollo (AW July 5, p. 21), ensure that the safe return of the first U.S. astronauts to explore the lunar surface will hinge on the precise execution of a audacious maneuver 246,000 mi from earth.

The Gemini program, emphasized until now by the patterning Mercury flights and the preparations for Apollo, now assumes an even greater importance in the new venture. Gemini flights, the necessary first step, will witness the first rendezvous of the U.S. space program in a circular, 150 mi high orbit at the earth.

Intimate of this venture is best explained in terms of the references within which the plan must work. During the first phase of docking, as the capsule is closing with its target at a rate of 1.5 fpm, one foot of unoriented lateral displacement or 10 deg of angular misalignment will spoil the attempt. Semiaxes tolerances probably will apply to rendezvous in lunar orbit.

In a extension vote, National Aero-

nautics and Space Administration management council decided to concentrate gravity on the lunar orbit rendezvous approach. An easier but highly tentative decision to return earth orbit as the primary objective of the program had been made. Following studies started by Marshall Space Flight Center, recommendations made by the Goddard Committee on large-scale vehicle planning monitored this decision.

A few years ago, however, Marshall reversed itself and endorsed lunar orbit rendezvous—the technique that was favored by NASA's Manned Spacecraft Center in Houston.

Flexible Approach

NASA is careful to point out that six to eight years will elapse before the first Apollo venture, and that even the lunar orbit rendezvous decision may be changed. Nevertheless, as it is now defined, the U.S. manned lunar landing program will follow this pattern:

Launch vehicle will be a single Saturn C-5, with a Boeing S-IC first stage powered by six Rocketdyne F-1 engines developing a total of 7.5 million lb thrust. In second or S-II stage, built by North American, will house a cluster of five hydrogen-oxygen fueled Rocketdyne J-2 engines, each developing 210,000 lb thrust and rated to the lunar excursion module. The three-component Apollo vehicle—command module, service module and lander—will separate from the S-IB and fly on to lunar orbit. In lunar orbit, the modules will enter the long though-as-in-hell

over J-2 engines, each developing 210,000 lb thrust. The Douglas S-IB third stage will incorporate a single J-2 engine.

The entire vehicle and Apollo spacecraft will be assembled in a virtual space station built by the Contractual Design team for the astronauts will have been developed by NASA by this fall. After assembly and systems checks are out, the entire vehicle will be moved to its launch complex by a rubber-wheeled, crawler-type transportor-launcher, which NASA has decided is superior to barge or rail transportation systems for that purpose.

By using the vertical assembly building and the crawler, NASA hopes the three Saturn vehicles need spend on the pad prior to launch will not be more than two weeks, with the exception of a small, launching schedules which now allow for possible revised launch windows, will gain some flexibility.

Standing vertically on its pad, the fully-loaded S-II will be 125 ft tall and weigh about 6 million lb. The overall spacecraft, tipped as an escape tower very similar to those employed in Mercury flights, will consist of three units:

• Command module, weighing about 10,000 lb and 12 ft high, will house the Apollo crew during liftoff and the three lunar phases of the mission. It will have

Technical Challenge to NASA

a 15-ft. dia. diameter and a 33 deg angle on its side.

• Service module, weighing 23 tons and 23 ft. high, will contain the propellant for mid-course correction and earth return. Diameter also will be 11 ft. Propulsion system probably will incorporate liquid oxygen/liquid hydrogen.

• Lunar module, weighing about 37 tons and 20-ft. dia., will carry two astronauts to and from the lunar surface. It will use solid hydrogen/oxygen propellant in a piston indigenous dust that of the service module.

North American's Space and Information Systems Division is contractor for the command and service module. Design of the excursion module will be delayed during the next three months, as the next three months will be spent on the S-IB stage and their integration in space.

During this interval, the S-IB managers will continue the long and often arduous task of calculating, in crucial and now pressing high-level detail, how much weight the exposed big. When the attachment was complete, the empty S-IB stage would be jettisoned, leaving the service module's propulsive system for use in possible aborts. Thereafter, the big would serve as the upper module of the spacecraft.

An alternative technique would involve a mechanism was attached to the service module to extract the big from

one of the S-IB engines will give the spacecraft a nominal escape velocity of 15,000 mph. Total spacecraft weight at that point is predicted to be about 85,000 lb. Even if that increases slightly, as is expected, C-3 hrs on ejection capability of about 90,000 lb, thus affording some design latitude.

When the spacecraft is on its final maneuver to the lunar surface, the upper portion of the S-IB is jettisoned by the command-service module combination by use of two mechanisms. The method now preferred by NASA involves total separation of the command-service module from the S-IB stage and their integration in space.

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An alternative technique would involve a mechanism was attached to the service module to extract the big from



LANDER landing gear assembly will be used at launching and put into use from the lunar surface to the orbiting spacecraft. Through out reentry phase, astronauts in the lander will maintain voice and radio contact.



SERVICE MODULE will contain, in addition to various equipment needed such as the fuel cells, the propellant and engine for return flight and anti-collision correction. It will be jettisoned prior to entry. Typical mission will consume 7 days; 5 days in orbit, 2 in lunar exploration and 2.5 in the return flight to earth.

the S-4B stage, and position it on top of the Service Module (AM July 2, p. 82).

During the initial phase of the mission, the Apollo crew would complete its systems checklist. To accomplish end-pause correction, the astronauts would make precisely on the command module's guidance system and entirely on the service module's propulsion system.

Velocity Gains

At an apogee point in space, still another boost at the service module would give the service spacecraft a 3,000 ft per second velocity increase in velocity in orbit, which would be about 5,000 ft/s. The total result would approximate a hand ± 10 deg in latitude from the lunar equator. It would be smaller and have an altitude of about 100 mi.

Dr. Joseph F. Shea, deputy director of systems in NASA's Office of Manned Space Flight, offered this description of the next step:

"After determining that all the subsystems are working and that the way is made to connect to the engines, two of the three astronauts will maneuver from the command module to the lunar excursion module. Once they are secured, we will flew, using the propulsive system, the lunar excursion module, put the excursion module on a trajectory which has the same period as the crew, for what is the command module service module combination, but has a much lower perigee, a range of approximately 10,000 ft. This will enable us to go down and in effect extract from an altitude of something like 10 mi the extended launch (end) heading area."

Elliptical orbit assumed by the log would have an apogee of several hundred miles. Its orbital period, as well as that of the spacecraft, would be about 2 hr. Once the thrust-to-weight ratio would be about 1 in 7.

If the two astronauts in the log decided to land, a second burn of the module's engines would bring them down into a hovering position above the moon's surface. The log's landing gear, stowed in a flat position along the struts, would then be extended.

From the bag's glass dome, the three astronauts in the lunar surface would be selected by the astronauts. Up to 1 man can be on the landing site; the two would be the excursion module's experienced crew.

In addition, the bag can be maneuvered as much as 1,000 ft in an arc while in hover.

For the rendezvous phase of the mission, the log's landing gear and the housing for its heat shield would be used as a launch pad and then discarded on the lunar surface.

After the two astronauts start landing about 7 to 10 sec, the landing gear would be jettisoned every two hours.

When the returning spacecraft was still about 5 hr away from a point directly over the landing location, the landing capsule would be jettisoned and the log launched on an intercept trajectory.

Repetitive landing taken surface by the astronauts from the lunar surface would have plotted the spacecraft's precise orbit.

Hold was up the lunar retraction pallets on the log would create a wide source of energy. Final docking phase would begin when the bag was 3-6 mi

from the mother spacecraft, a distance that could be calculated by radio or optical observations. When the velocity and plane of the spacecraft's orbit would be about 100 ft/sec, the log would be jettisoned and steered to an orbit on the command module.

The two astronauts on board the log would enter the command module through this lock and the bag would be jettisoned in the lunar orbit. Service module's propulsion system, with mass of about 20,000 lb thrust remaining, would bring the spacecraft out of orbit in a second.

Re-entry Procedure

Prior to reentry, the service module would be jettisoned and the command module weighing between 5,000 and 10,000 lb, graded to an 18-mile-wide reentry module. Angle of attack during reentry would be about 30 deg. When maximum pressure and deceleration are experienced, no propellant would be used except for attitude control.

NASA also is hopeful that, by the first Apollo flight, it will be able to return capsule atmospheric entry through the aeroshell phase.

Landing ratio of the command module is designed to be about 0.5 at separation speed and about 0.7 at subsonic speeds. Gemini capsule, in contrast, has a comparable ratio of about 0.25, while the Mercury capsule's ratio is effectively 0.0.

In exploring out, the reentry is through attitude control during the reentry. Apollo pallets should be able to land within a footprint 10 m square. Front breaking of the capsule may be provided by three 8-ft parachutes.

return the Gemini program prove that a paraglider or Rogallo wing is feasible.

With the most feasible possible by such landing site, NASA hopes the command module can be landed within an area the size of a large airport. Some much larger areas in U.S. plans states have been considered by the space agency, which is seeking a flat area with generally good visibility and low of the acceleration posed by a dense population.

At this early stage of know what the reentry procedure, there is a possibility that the C-7's will stay and the spacecraft, if it comes will have to describe an orbit in 1.5 earth orbits while waiting for the landing window. If this proves true, the Apollo crew probably can complete a preliminary checklist of emergency and evacuation module systems before reentering themselves in the 72 hr duration flight. Otherwise, systems checklist would take place on note to the moon.

Abort Possibilities

Crossing orbits can be initiated during short day phase of the mission, after reentry of the S-4B can goes into a given the spacecraft velocity. For example, should a orbital system malfunction during the trans-lunar phase, return to earth could be accomplished in either of two ways:

• **Guiding to the moon in a long cone** and then using lunar gravity to slow and then using the rocket back to earth. The spacecraft then would use the command module propulsion system and the service module propulsion system to return. Effect of guidance corrections could be coordinated with NASA's deep space communications network. As a final option, only the command module would reenter the earth's atmosphere. This is the most probable method.

• **For more short techniques**, the most useful to cross a cone short of the moon's magnetic field.

Because the log's elliptical orbit is to have the most long period as the circular orbit of the mother spacecraft, the two should pass together once per revolution. Should an abort prove necessary after the log has descended, this meeting at the two orbital paths affords a natural opportunity for rendezvous.

According to Shea, the two trajectories of the log are constructed that all travel during the log's orbital period, however, translation will be slowdown on the lunar surface, the astronauts in the command/service module rendezvous will return line-of-sight communication with the two astronauts on board the log. Two-way radio contact also will be maintained during their critical maneuvers. As a result, Shea said, "a very simple space telecommunication" will enable

the log to abort and rendezvous with the service spacecraft at any point prior to touchdown.

In addition, the mother spacecraft would carry redundant guidance and control systems that would enable it to "climb" or "bounce" the log and effect rendezvous if necessary. Thus, the return rendezvous could be controlled either from the log or by the log informed at the control of the orbiting spacecraft.

Control From Earth

As a further safeguard, NASA experts that an deep space station-keeping facility (DSCF), which then will consist of three stations complex located about 120 deg apart on the earth's surface, will be able to plot the command-service module's orbit with precision. This makes about the entire long orbit rendezvous, with the exception of its final docking phase, could be commanded from space on earth.

Similarly, the log's orbital object also would be monitored from the deep space net.

Life-support equipment and supplies will be positioned on the lunar surface storage area to the astronauts' need. Before the space agency decides to develop the command lunar logistics vehicle that would carry materials to a point near an intended landing site, it also will design a 10 to 12 month study of the entire mission. The agency believes this study will help in the development of the vehicle.

It would be relatively simple, NASA officials have said, to design the logistics vehicle for the command lunar exploration mission analytical studies to the Post-Post program. Even though Congress

defended about all funding for Post-Post for NASA's fiscal 1967 budget, it is expected to approve funds for the logistics vehicle if it can be justified by the space agency.

Presently NASA still attach to this program in reflected in the command of the funding officials.

"It would appear," NASA Administrator James E. Webb said recently, "that if we go forward with a lunar excursion module, a logistic support vehicle would be very important. To me in concept, it would be important. It would also appear that it might be expanded into a different support vehicle."

"We expect to do this with very great care," Webb said, "because this means a big day of development of untried lunar landing equipment, which is quite an undertaking."

D. Bennett Holmes, director of NASA's Office of Manned Space Flight, said that if the mission were scrapped, the two astronauts would be lost unless they could return to a logistics vehicle on the moon's surface.

Lunar Exploration

Using this equipment, which is the command spacecraft, the astronauts could spend up to four days exploring the moon's surface although each Apollo mission will go for days of only 24 or less. Nevertheless, through development of a direct ascent logistics module, NASA could perform the technology of prolonged and hardy, repeat flights on the moon. While more complex than the present planetary flights, these are important in the future, more accurate star maps for the preparation of all such trips.

If NASA initiates development, the vehicle slated to launch the first logis-



COMMAND MODULE will weigh 5,180 to 10,000 lb at reentry. Once efficient, it will penetrate the earth's atmosphere within a radius 40 mi wide. During descent, new will maneuver the capsule toward a land recovery area about 10 mi square. Either three parachutes or a Rogallo-type wing will be employed to bridle its touchdown.

ter package will be the Saturn C-18 which will bring up to 2,100 lb on the least weight. A second weight will take one of C-5, which could place a 27,000-lb package as the most at that mass.

Appling rendezvous techniques practiced in the Gemini program, mating of Apollo's command/crew-crew module combination will begin about 1967. Again, NASA will utilize the C-18 vehicle, which can target three modules, orbited, as far as earth orbit without using several thermal panels of the Mating capsule. Still on the track, a heat shield will be used by the big bag and service modules to permit rendezvous practice in earth orbit.

At this point, NASA's thinking calls for injection of all three modules into earth orbit during 1967. Several rendezvous operations will follow each successful injection. During the first of these, however, NASA probably will not allow astronauts to enter the bag and exchange it from the other two modules.

Command Module

Indeed, early rendezvous will be controlled from the command module, as it would be during a hot version. Later in the program, NASA has not yet decided how many test flights will be necessary—astronauts will be committed to the bag. In this, at least, will be ahead as much as 50 lb in before rendezvous is attempted, both from the command module and from the bag.

"It is our intention," Shad said, "to exercise carefully the rendezvous maneuver. It will be done in a way that it will be performed in the name of the program. This will involve reading the bag out to the limit of its separation loss, plus giving it a variety of velocities and displacements relative to the spacecraft."

Possibility of connecting the bag and the spacecraft by cable during the first few rendezvous operations has been the cause and is tentatively discounted by NASA.

After studying for the better part of a year the three concepts of rendezvous for manned lunar landing, NASA has chosen a based on direct approach:

- Lunar orbit rendezvous would mean the return about 20 months earlier than direct ascent, or up to 15 months earlier than earth orbit rendezvous. Although it would cost 18 to 15% less than either of these two modes, this does not mean that will be a 30 to 15% savings to the overall cost of the Apollo program, which will involve spending \$20 to \$30 billion.
- Earth orbit rendezvous, possibly because it would enable launching two C-5 instead of one, would have only half the probability of success, whereas

around rendezvous and our backlog for the latter is so enormous that the two methods are equally and the order is following close behind on a tight construction schedule. Now, with the requirement of launching two C-5 vehicles within a day of each other delayed, the first two should still be launched with dispatch but the third and fourth might lag by as much as several years.

Lunar Operations Center presented to the National Commission of Building Research last in the Vertical Assembly Building (AVB) July 4, a 115-page report on the feasibility of launching a two-C-5 vehicle within a day of each other. The report, which includes a discussion of the problems of launching on the massive foundations required for the 400,000-lb C-5 structure on a preformed base and the possible deleterious effect construction might have on work proceeding in adjacent bays, NASA is inclined to build the first four bays simultaneously. Fifth and sixth bays, which are expected to be taller than the first four because longer nuclear stage will be substituted at the third stage of Saturn C-5 instead of the 54-ft, will be built later.

Early center personnel requested that the first four bays be built at Cape Canaveral will not be used for that. The late loading reasons and the distance to the launch-earlier technique gives them more time in which to finish the work assigned to the center.

Progress also has been made by NASA to use the smaller version of transportable launcher (AVB) July 3, 1963 upon which the Saturn stages and the Apollo modules are to be assembled and checked out at Cape Canaveral. The crew consists of two separate transportable tables which will be jettisoned into orbit and a test module will be placed on the table which will use the Saturn Apollo module from the assembly area in the launch stand.

After removal of the launch vehicle and the spacers in the Vertical Assembly Building, the carrier will rise 50-in.-dia. passable area to clear the table from the ground and then drive the entire unit out on a launch stand some two miles distant. Once properly positioned on the stand, the area will be leveled, the table with the Saturn stages will be jettisoned (40 ft) and the test module driven out from underneath.

The big composite rocket will be built into the table to check its assembly of the three booster stages and three upper stage components and will be the first pass of checklist equipment during the assembly phase. Use of the two digital digital computers in the launch control center will monitor remote control of the vehicle while it follows from the Vertical Assembly Building and will respond to data provided by the computer in the table's base.

Apollo Endorse

North American Aviation Space and Information Systems Division is evaluating the use of an intermediate stage to reduce the weight of about 30,000 lb for the endosat proposed for Apollo 8. A test model with a diameter of about 3 ft and length of about 2 ft. Located at the end of the endosat, the endosat should be a simple affair, the outcome will present difficult thermal problems, with temperatures expected to depend on these same factors—just as in the case of the overall Apollo 8, the thermal conductivity of the endosat material, and its assembly.

At least the basic method is also being tested and developing a track record of the C-5 plus a 30-ton gear of loading and touchdown modules, which could result in a 48,500-lb payload onto the lunar surface.

• Direct ascent would require development of the Nova booster, as well as the heating and touchdown modules, in a parallel program. As a result, NASA has decided to postpone the Nova development during the next 18 months, when other financial demands imposed by the Apollo program will be at a high level. However, Nova development would produce a vehicle with a payload capability only 60% greater than that of C-5. C-5, by comparison, will be able to launch 30 tons the weight of the upper C-1 Selenia.

It follows that NASA will defer Nova development for at least two years, postpone development of the Nova booster and touchdown modules for at least 18 months, which will involve scaling the bag out to the limit of its separation loss, plus giving it a variety of velocities and displacements relative to the spacecraft.

Progress also has been made by NASA to use the smaller version of transportable launcher (AVB) July 3, 1963 upon which the Saturn stages and the Apollo modules are to be assembled and checked out at Cape Canaveral. The crew consists of two separate transportable tables which will be jettisoned into orbit and a test module will be placed on the table which will use the Saturn Apollo module from the assembly area in the launch stand.

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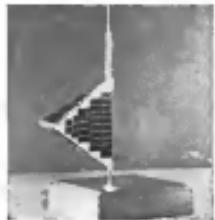
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NASA Reports Top Industry Contractors

National Aeronautics and Space Administration has announced the 100 contractors receiving the highest net value direct awards from NASA during the period July 1, 1962 to Dec. 31, 1963. (See chart on page 10.) Direct awards of \$25,000 or more, \$10 million or 45% were placed in areas classified as declassified.

The 100 top contractors ranked by direct awards

Rank	Contractor	Direct awards	Percent
1	North American Aviation, Inc.	\$1,668	3
2	Convair-Aerospace Div.,	319	1
3	General Dynamics Corp.,	318	1
4	Boeing Co., Seattle, Wash.	316	1
5	Lockheed Aircraft Corp.,	315	1
6	McDonnell Aircraft Corp., St. Louis, Mo.	314	1
7	Douglas Aircraft Co.,	313	1
8	Convair, San Diego, Calif.	312	1
9	Grumman Corp., Bethpage, N.Y.	311	1
10	Pratt & Whitney Corp., East Hartford, Conn.	310	1
11	General Dynamics Corp.,	309	1
12	Rockwell International Corp., Los Angeles, Calif.	308	1
13	North American Aviation, Inc., Long Beach, Calif.	307	1
14	General Dynamics Corp.,	306	1
15	McDonnell Aircraft Co., St. Louis, Mo.	305	1
16	Convair, San Diego, Calif.	304	1
17	Boeing Co., Seattle, Wash.	303	1
18	Convair, San Diego, Calif.	302	1
19	General Dynamics Corp.,	301	1
20	Convair, San Diego, Calif.	300	1
21	Grumman Corp., Bethpage, N.Y.	299	1
22	McDonnell Aircraft Corp., St. Louis, Mo.	298	1
23	Convair, San Diego, Calif.	297	1
24	General Dynamics Corp.,	296	1
25	Convair, San Diego, Calif.	295	1
26	Pratt & Whitney Corp.,	294	1
27	General Dynamics Corp.,	293	1
28	Convair, San Diego, Calif.	292	1
29	General Dynamics Corp.,	291	1
30	Convair, San Diego, Calif.	290	1
31	Pratt & Whitney Corp.,	289	1
32	General Dynamics Corp.,	288	1
33	Convair, San Diego, Calif.	287	1
34	Pratt & Whitney Corp.,	286	1
35	Convair, San Diego, Calif.	285	1
36	General Dynamics Corp.,	284	1
37	Convair, San Diego, Calif.	283	1
38	Pratt & Whitney Corp.,	282	1
39	Convair, San Diego, Calif.	281	1
40	General Dynamics Corp.,	280	1
41	Convair, San Diego, Calif.	279	1
42	Pratt & Whitney Corp.,	278	1
43	Convair, San Diego, Calif.	277	1
44	General Dynamics Corp.,	276	1
45	Convair, San Diego, Calif.	275	1
46	Pratt & Whitney Corp.,	274	1
47	Convair, San Diego, Calif.	273	1
48	General Dynamics Corp.,	272	1
49	Convair, San Diego, Calif.	271	1
50	Pratt & Whitney Corp.,	270	1
51	Convair, San Diego, Calif.	269	1
52	General Dynamics Corp.,	268	1
53	Convair, San Diego, Calif.	267	1
54	Pratt & Whitney Corp.,	266	1
55	Convair, San Diego, Calif.	265	1
56	General Dynamics Corp.,	264	1
57	Convair, San Diego, Calif.	263	1
58	Pratt & Whitney Corp.,	262	1
59	Convair, San Diego, Calif.	261	1
60	General Dynamics Corp.,	260	1
61	Convair, San Diego, Calif.	259	1
62	Pratt & Whitney Corp.,	258	1
63	Convair, San Diego, Calif.	257	1
64	General Dynamics Corp.,	256	1
65	Convair, San Diego, Calif.	255	1
66	Pratt & Whitney Corp.,	254	1
67	Convair, San Diego, Calif.	253	1
68	General Dynamics Corp.,	252	1
69	Convair, San Diego, Calif.	251	1
70	Pratt & Whitney Corp.,	250	1
71	Convair, San Diego, Calif.	249	1
72	General Dynamics Corp.,	248	1
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88	General Dynamics Corp.,	232	1
89	Convair, San Diego, Calif.	231	1
90	Pratt & Whitney Corp.,	230	1
91	Convair, San Diego, Calif.	229	1
92	General Dynamics Corp.,	228	1
93	Convair, San Diego, Calif.	227	1
94	Pratt & Whitney Corp.,	226	1
95	Convair, San Diego, Calif.	225	1
96	General Dynamics Corp.,	224	1
97	Convair, San Diego, Calif.	223	1
98	Pratt & Whitney Corp.,	222	1
99	Convair, San Diego, Calif.	221	1
100	General Dynamics Corp.,	220	1



Miniature Satellite

Teardrop-shaped satellite developed by Space Technology Laboratories, Inc., has been piggybacked aboard Miltex or Space Shuttle flights. The satellite's on-orbit damage resistance and its ability to withstand thermal extremes on earth orbit make it a valuable test bed for future space vehicles. The satellite's small size and low weight make it ideal for use in space shuttle payload bays. It is designed to withstand temperatures from -100° to 200° F. The satellite's unique design allows it to withstand the extreme temperatures of the space environment. It is also designed to withstand the high temperatures of the space shuttle's payload bay. The satellite's unique design allows it to withstand the extreme temperatures of the space environment. It is also designed to withstand the high temperatures of the space shuttle's payload bay.



Beech works wonders with titanium to save weight... increase space payloads

Largest titanium structure ever built, and Beech built it.

The large tank in this picture is made entirely of titanium. Built by metal-working experts at Beech. Much of the equipment used by the Aerospace Division is one-of-a-kind and must be designed and built under the most rigid controls. Other jobs make use of Beech's extensive metal bending capabilities.

This means more payload.

Fabricating titanium is an old story at Beech. And if it's something that's never been done before, that's not unusual. In this case the upper and lower hemispherical tank heads were chemically milled in a complex pattern to extremely close tolerances.

Production welding of .012" titanium is S.O.P. at Beech. Much of the equipment used by the Aerospace Division is one-of-a-kind and must be designed and built under the most rigid controls. Other jobs make use of Beech's extensive metal bending capabilities.

Sophisticated fabrication is one of the many elements that make up the comprehensive Beech capability. It's one reason Beech is well prepared to undertake complete system management responsibilities for a wide range of space-age projects. □

Other Beech Capabilities In Systems Management Include:



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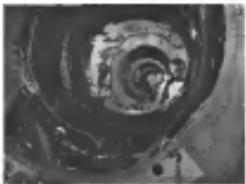
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AERONAUTICAL ENGINEERING



First prototype of the G-160 Transall twin turboprop transport, a joint French/German program, is assembled at Nord Aviation's facility at Melun-Villaroche for a Nov. 15 major first flight. Nord, which builds the wing, is responsible for assembly of the fast airplane.

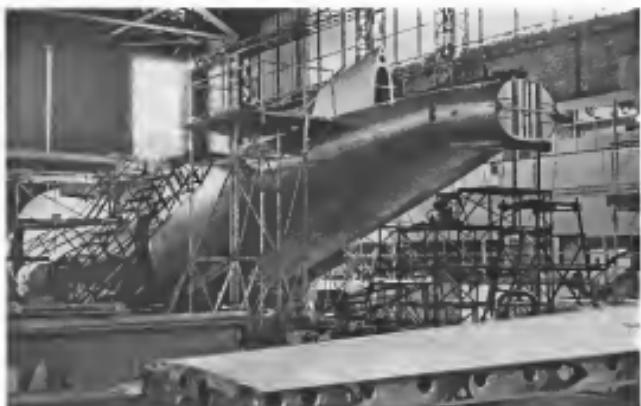
French Assemble First C-160 Transall, Super Frelon



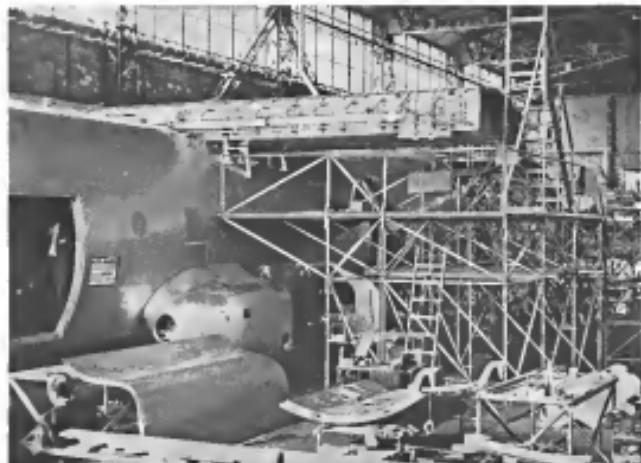
First prototype of the Sud ST13 Super Frelon helicopter, due to fly in December, is assembled at Sud's Mureaux plant. Unlike the prototype 1300 Frelon, the Super Frelon has a flying boat hull like the Sikorsky S-61. Sikorsky has a technical assistance agreement with Sud, largely concerned with dynamic components and tail of the first aircraft; other options have begun on the Sikorsky wheel stow. Tail rotor shafts started last week and Sikorsky has shipped the first rotor assembly, less blades, to Sud for test. Powerplants are three Turbomeca Turmo IC turbine engines developing 1,330 shp. Sud is testing for a 300-becoput maximum production rate.



AIRPORT, AIRLINE and SPACE TECHNOLOGY, July 23, 1962



Center aerofoil wing box is mated to the fuselage of the first Transall prototype. Werk Fliegerwerke, one of three German companies taking part in aircraft design, manages and builds the fuselage and tail section. Second and third prototypes will be assembled at Germany's first full-hangar underground construction plant, and the flying test flights are planned to begin (below). Powerplants for the fast aircraft transport are two Rolls-Royce Tyne RTY 20 turboprop engines.





Passenger version of the Dassault Mirage 3B, the first delivered to the French air force in June, features Mach 2 flying or supersonic cruise capability. Armament includes two 30-mm DEFA canons in frontfuselage, Matra R.530 for high-speed, right, and Sidewinder, below, eighty air-to-air missiles. Ejection seat is Hispano-Suiza Martin Baker Type 3A-4.

Mirage 3B Deliveries Begin; 3C in Production

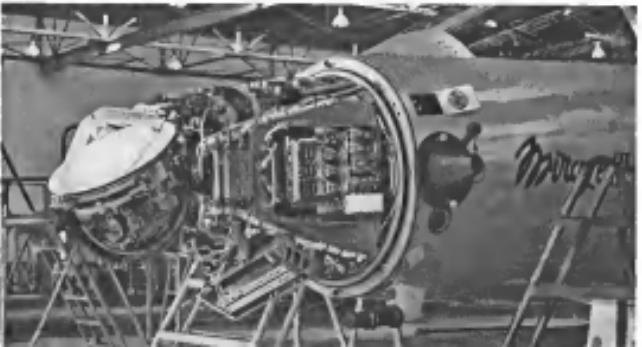
Mirage 3s are shown on the left at Dassault's plant near Bedford. Production rate is one per month.



Mirage 3C military escort fighter shown here on a Dassault Mirage 3C, the production version of the Mirage 3A. The engine develops 1,980 lb. thrust for 160 sec. to 3,080 lb. thrust for 60 sec.



Story for the Mirage 3B also includes the Nord AS 30 anti-aircraft missile (left) and wing-pod-mounted pod housing integrated seekers and additional fuel. Non-integral, CSF cruise fan control valve (bottom photo) is used on the Mirage 3C.





Now on stream...

America's newest, most advanced production facility for large solid motors

USAF PLANT 78

operated by THIOKOL
to build MINUTEMAN first stage

Air Force-Thiokol Plant 78 provides advanced production capability for the first stage motor of the large MINUTEMAN missile. This modern weapon system is a significant addition to America's substantial deterrent might and to the defense of the free world.

The technological advances incorporated into the plant design have been derived from Thiokol's 15 years of experience in solid propellant rocketry. The entire facility is new, and its unexcelled materials handling and propellant processing equipment is the most efficient yet devised.

Closely proximity of Plant 78 to the Wasatch Division Research and Development facilities and currently integrated managerial and production staffs are facilitating Minuteman's transition from development to production.

Construction schedules and cost objectives - both have been met and bettered in providing this latest arsenal of power for peace.

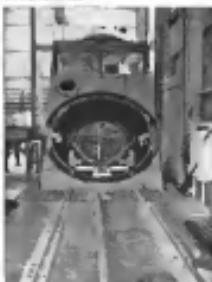
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WASATCH DIVISION: Patriotic research and development products defend our resources for valuable long-term existence.



RESEARCH LABORATORY: Disclosed quality test



LOAD AND LINE STATION: Exemplified integrated design for loading and manufacturing of large units.



PIPE INSPECT TEST: Assures pipe reliability without

DOD Group Studies Emitter Interference

By Philip J. Kline



This airplane detects, early warns, controls intercepts, and has a heart.



This is the heart.

The airplane belongs to the U. S. Navy. It is a Grumman WRF-1 Hawkeye. It is one of the largest carrier-based aircraft, is manned by a crew of five and was designed to perform airborne early warning missions. Technically, for long range radar detection and control of intercepts with minimum reaction time.

The heart of the WRF-1 is its avionic electrical system: two Bendix[®] Type 28895-3, 60 KVA AC brushless generating systems direct driven by the airplane's turboprop

engines. These brushless systems—along with companion Bendix solid state regulation and protection electronics—supply reliable, efficient electrical power to help the Hawkeye do its job. Which is a big one.

We build a complete line of brushless generating systems, rated from 10 to 75 KVA. All are available with solid-state regulation and control/protective equipment. For up in the air, or down on the ground. Tell us what you need. Write us in Englewood, N. J. Attn: General Products.

Red Bank Division



search. Perdition, which carries out technical operations under contract to USAF.

A few examples illustrate the scope of the problem which has been assigned to ECAC:

- Rand Corp. study several years ago of the Defense's defense data link developed for guidance of the B-52s revealed that it was extremely vulnerable to interference from other military programs, particularly to communications in the space environment. The B-52's performance was changed over to use a time-difference multiple data link system.

- Air defense radars in the Southern California area have concentrated a major interference problem because of their concentration and the topography of the area. New frequency diversity radars, being installed at Air Force facilities, are causing interference with civil services, state television, and private telephone systems.

- Test facilities, such as Eglin AFB and Cape Canaveral, have experienced such severe interference problems that it is necessary to halt work and shut down major experiments prior to a missile launch or space mission to insure proper operation of assigned telemetry and control systems.

Measured by ESD

The new facility, headed by Col Charles C. Wootton, USAF, is primarily assigned by Air Force Systems Command's Electronic Systems Division.

The center is largely staffed by personnel employed by the Avionics Re-

search Foundation, which carries out technical operations under contract to USAF.

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In a typical area covering knowledgeable districts, there may be as many as 50,000 different sources of radio signals, including both civil and military. The situation is dead, with transmitters and receivers changing frequency and new stations entering the area while others leave.

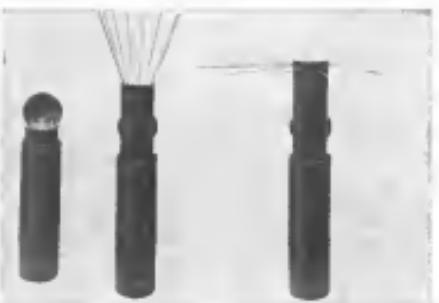
An attempt to determine interference problems by conducting "interference surveys" will probably be productive, especially if it is conducted by a team of experts, according to A. L. Hirsch, Rand Corp. scientist who serves ECAC as a consultant.

Simulation Sought

For this reason, ECAC seeks to develop techniques and gather data which will enable it to carry out mathematical analysis and simulation to predict noise levels and interference and to devise methods for reducing interference, according to J. Paul Gimpel, technical director here.

To accomplish this objective, ECAC currently is in the process of acquiring two basic types of information:

- Spectrum signatures, a catalog of the ultimate characteristics of all major types of military transmitters and receivers. For transmitters, this will include such things as output power, ignoramus emission, emission spectrum, modulation characteristics, orthomodulation characteristics, and center frequency stability. Receiver characteristics to be cataloged include sensitivity, selectivity, ignoramus response, overall ignoramus, ignoramus



Antenna Withstands Thermonuclear Blast

Model of 12-ft. antenna developed by Sylvania Electric Products, Inc., to withstand thermonuclear explosion was built like shelf and stands to full operational position. Antenna's performance would equal that of a 12-ft. high conventional antenna.



Traveling Wave Laser

Traveling wave laser, consisting of a coil of glass fiber optics wound with Newbolders reportedly achieves most efficient use of pump power. Developed by Micro-Fiber Inc., the laser beam consists of fiber bundle of single optical fibers with total internal reflection characteristics. Less than 40 watts of pump power are needed to initiate laser action at room temperature.

Adjustable signal intensification, pulse discrimination, CW deactivation, dynamic range and oscillator relaxation. Environmental life, a listing of every mission, from space-craft to terrestrial, lists types of units, according to the manufacturer, several on off-duty cycle, operating frequency, antenna elevation above sea level, antenna pointing azimuths, etc.

Spectrum Signatures

Initially, ECAC is continuing its data collection on obtaining spectrum signatures and environmental data on pulse-type radars operating above 100 MHz in the 2000 Hz range.

Presently, ECAC has spectrum signature data for 100 radars, but hopes to increase this to approximately 350-400 by next summer. Because the measurements required to obtain a spectrum signature are costly and time-consuming, ECAC is using data available from equipment technical manuals for preliminary analysis until full spectrum signature data becomes available. It now has such limited data on approximately 35 additional radars, plus full spectrum signatures on about 25 communications equipment previously gathered by Georgia Institute of Technology.

Each of the mobile stations is responsible for collecting environmental data and spectrum signature data for its own equipment and facilities, using either its own personnel, an outside contractor or both. Each of the agencies has, or will have, a deputy director assigned to provide liaison.

Survey teams to gather data for the environmental data base just gave out to the mobile stations in the Pacific, Atlantic, and Gulf regions will go to each of the other Zone-1 centers, Andrew Corp., Chicago. An inset has horizontal plate beam widths of 100 deg.

To make use of the spectrum signature and environmental data, it is necessary to derive mathematical models which describe conditions under which interlayer ocean and the bottom which influence the intensity of the interference. To speed the analyses, these models must be designed to permit their use in digital computers.

The Georgia Institute of Technology, under subcontract to Aeronaut Research, currently is developing these model models.

Model Models

The basic model, called a one-layer ocean interference situation, considers a single parameter as an interference source for a single receiver, taking into account such factors as viewing direction of transceiver situation, an additive parameter power density spectrum of emitted energy, antenna azimuthality over the frequency band, its threshold setting, and in the case of a radar, the up power. When the interference will prevent the receiver from operating, a few such models will be developed for different classes of receivers.

A second type of model under development, called a Vlasov model, will describe mathematically the operation of special circuit functions, such as moving target indicator and fast time constant components.

By combining an appropriate basic model with suitable element models, it should be possible to come up with mathematical model equations of use spectrum signature experiments, according to Fred D. Newbold, head of the ECAC radar department. Additional models are being developed to introduce the effects of propagation characteristics. Still another, called a system model, will cover a situation where two different types of equipment are involved, such as a radar and a communications equipment.

Finally, models will be developed to permit which parameters in an environment can most easily be changed to minimize interference.

By November, the center here expects to have installed a large, high speed Univac 1107 which will be used to carry out analyses using the mathematical models and data obtained from current equipment and environmental surveys.

To handle typical situations in which there may be 28,000 radio frequency transmitters in the ocean area, ECAC is developing a thinnest-layer separator program. Power data on all 28,000 emitters, the computer will search out those, perhaps 10%, whose characteristics indicate possible interference.

In the next stage of development, these 2,000 potential interference emitters will be analyzed in some detail to find perhaps another 10% which are probably interference problems. In the final stage, those remaining 200 would be analyzed in detail to obtain a statistical probability distribution of the likelihood of interference for any specific equipment, Newbold said.

Model Validation

To prove the accuracy of the mathematical models, upon which future interference studies will be based, ECAC is sponsoring three model validation tests, according to Herbert M. Sada, ECAC deputy director for technical operations.

The validation tests are as follows:

• **Radar Air Defense:** Conducted recently, concerned high level check the propagation model and memory effects of a one-to-one radar model. Test was run using two L-band surveillance radars, the AN/TPS-31 and the AN/TPS-1D.

• **Naval Air Navigation Electronics Project:** Permanent Radar, Md., is checking the basic one-to-one interference model for two radars using two L-band surveillance radars, the AN/TPS-1D and AN/TPS-42.

• **Air Force Electronic Power Ground:** Ft. Detrick, Md., not the model for multiple radars, using one M-33 surveillance radar operating at S band and one, seven, Tens. Test will involve propagation through seven terrain and reflections from mountains.

The Navy team will include experiments designed to determine the effect on interference of using components made by different manufacturers. This involves the substitution of different types of magnetrons, crystal diodes and solid oscillators.

The Defense Department has given a number of specific, troublesome interference problems to ECAC, either to obtain solutions or to double-check proposed solutions. This gives the new center practical experience in current

Transportable Antenna

Transportable high frequency communications antenna weighing less than 1,000 lb. and 100 ft. diameter, developed and can be installed in eight hours according to manufacturer, Andrew Corp., Chicago. An inset has horizontal plate beam width of 100 deg.

PRECISION with SIMPLICITY FROM DELCO RADIO

That's the big feature in Delco Radio's new 175 VA and 250 VA static inverter power supplies. These all-transistor units offer increased reliability through simplified circuits. Both static inverters are designed for either airborne or ground applications and will withstand overload and output short circuit conditions indefinitely, delivering at least 110% of rated output before going into overload protection. Units automatically recover to full output upon removal of overload and short circuit. Units are designed to meet the environmental requirements of MIL-E-5273C. For further information on military electronics write Delco Radio's Military Sales Department.



175 VA static inverter



250 VA static inverter

ELECTRICAL SPECIFICATIONS

175 VA STATIC INVERTER

Input	Output
Voltage: 21.5 VDC ± 10% per MIL-STD-704	Voltage: 22.5 VDC ± 10% per MIL-STD-704
Current:	Current:
Power:	175 VA single phase 0.5 lag to 1.0 power factor
Voltage:	175 V adjustable from 110 to 120 volts
Regulation:	±1 volt change for any variation of load between 10% and 110% of full load, and repeat voltage between 20 VDC and 30 VDC.
Frequency:	60±1 cps
Distortion:	Frequency changes less than 1.0 cps for all measurements, load and input voltage variations.
Efficiency:	Less than 56% total harmonic distortion at full load

250 VA STATIC INVERTER

Input	Output
Voltage:	Voltage:
Current:	Current:
Power:	250 VA single phase 0.5 lag to 1.0 power factor
Voltage:	115 V adjustable from 110 to 120 volts
Regulation:	±1 volt for any variation of load between 10% and 110% of full load, and repeat voltage between 20 VDC and 30 VDC.
Frequency:	60±1 cps
Distortion:	Frequency changes less than 1.0 cps for all measurements, load and input voltage variations.
Efficiency:	Less than 56% total harmonic distortion at full load

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RADIO
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A NEW CHALLENGE

— of significance to United States ballistic missile programs

— of unusual interest to engineers and scientists

DURING THE NEXT FEW MONTHS THE U. S. AIR FORCE Ballistic Systems Division will shift its operations from Los Angeles to Norton Air Force Base near San Bernardino.

Concurrently, there is being established the San Bernardino Operations of Aerospace Corporation, the unique public trust organization formed in June 1964 to serve the U. S. Government. This action will ensure continued and effective technical progress in the advanced programs of the Ballistic Systems Division.

Several of the principal surface missile programs planned for the future will be shifted to San Bernardino. Concentrated in this friendly community, a small but eminent number of the nation's best brain will function in close interdisciplinary teamwork. San Bernardino will be a place of challenging assignments and deep satisfaction for people concerned with aerospace research and development.

The San Bernardino Operations will work closely with the established and growing Aerospace organization at El Segundo, where approximately 3600 are now working in a broad, interdisciplinary spectrum. The El Segundo staff generates advanced systems research and planning, general systems engineering and technical direction of many established ballistic missile and space programs, and laboratory research to anticipate and encourage significant state-of-art developments.

The San Bernardino center will include headquarters of programs with a large proportion of engineers and scientists widely known for their technical ability, experience, imagination and leadership. Opportunities for advancement and promotion can be expected to be considerably above average for senior engineers experienced in and capable of program management, advanced development, advanced systems development and analysis of ballistic missile systems.

Similar opportunities exist for engineering specialists in such fields as propulsion, fluid mechanics, solid mechanics, performance analysis and long-range guidance and control, estimations, data computers, load evaluation, trajectory analysis, optics and optics.

The new modern facilities will be located within ten minutes' drive of several attractive neighborhoods. People working here will have a choice between living in warm dry country or higher, cooler hill country. Yet Los Angeles is within an easy drive on a non-stop freeway.

Aerospace looks forward to staffing its new offices with motivated qualified individuals who can contribute to the work of strengthening national defense. The opportunity is immediate. Applications are being received now. Write to Mr. Charles Lofstrand, Room 101, Aerospace Corporation, Box 59881, Los Angeles 45, California. Aerospace is an equal opportunity employer.

Organized in the public interest and dedicated to providing outstanding leadership in the advancement and application of aerospace and technology for the United States Government.



problems and an opportunity to test some of its concepts. Currently assigned operational problems include the following:

- San Diego problem, involving interference between air defense radars in the Southern California area. Initial field measurements have been completed and a more detailed set of measurements is scheduled to get underway in August. This will include data on pulse amplitude, frequency, separation and pulse width distributions.
- MCMAS problem, involving interference from radars in the Mississippi Air Defense Sector of SAGE. Equipment involved in the analysis includes radars operating in the 223-400 mc band, FM telecoms, FM ground sites, and ground-to-air voice communications at Eglin AFB, Fla.

• Cheyenne Bay problem, involving interference among radars over the agency's test range located in Wyoming.

• Spokane problem, the long-term analysis of possible interference from Air Force's new electronically scanning space detection and tracking radar under development by Remotek Radars.

Technical Director George emphasizes that ECAC's role is that of a consultant and advisor in the Defense Department, the individual military services, and to industry designers. The center has no responsibility to resolve technical conflicts.

Data and knowledge acquired by the center will go to all data users for use. It includes the work of Remotek Radars Corporation (RMC), which makes Doppler data-gathering obituaries to government users.

In addition, ECAC expects to serve as a consultant to individual users in planning new experimental programs to examine possible relationships with other equipments used in other services. ECAC also expects to help operational commanders derive optimum tradeoffs to minimize interference problems.

This service also should be of value to industry designers developing new equipments to minimize the likelihood of interference problems.

The Defense Department's program to reduce this problem encompasses areas beyond the scope of ECAC's operations.

For example, Defense intends to emphasize reduction of spurious emission in the development of new radars and equipments.

ECAC is located at the Naval Electronics Engineering Station in Anacostia. The center expects to have a staff of about 150 by August, the majority of these personnel.

Deputy director in charge of ECAC from three sources include Lt. Col. John A. Cale, USA, Col. Albert M. Bruson, USAF, and Maj. Gilbert O. Nicholais, USAF.

problems and an opportunity to test some of its concepts. Currently assigned operational problems include the following:

• Bond for Transistor Reliability

Hughes Semiconductor is adapting all its transistor products to a permanent bonding technique that the transistor manufacturer, Fairchild, cannot. Under this technique the transistors can withstand other environments. The bonded connection between the three active regions of a transistor and bonding pads on a wafer have long been a source of difficulties which should be eliminated with this technique, according to the company.

• Liquid Laser Operation

After successful operation of a liquid laser, using new techniques developed which caused the green light to be absorbed by Zinc Selenide, Inc., San Bruno, Calif., the company has an ultraviolet source, the new technique liquid laser rodiles in the 3,100 to 5,500 angstrom region, a wavelength which promises some unique permitting applications for underwater communications and detection. Previous attempts to achieve liquid laser action using other materials were unsuccessful because heat killed liquid and caused absorbed heat to crack crystal. Zinc Selenide does not revert to heat killed and until now it has applied for patents on the new technique and has sold some elements to military and commercial companies.

The company is offering new infrared liquid lasers instead for sale at \$15,000 per unit in quantities of 25 or, with lower prices on larger quantities.

• Heatline Corp.

Will supply a well-designed Spacelab 2000 for a different mission in April. While Spacelab 2000 is a 2000-gram station, the successor is a 2000-gram station, making it much faster than a digital general purpose computer in solution of differential equations, the company says.

• ITT Federal Laboratories

Ind. will design and build a homing star tracker and star sensor units for use in the Orbiting Astronomical Observatory (OAO) under contract awarded to Grumman OAO prime contractor.

• Minneapolis-Honeywell, Hattori, Inc., will supply a 2000-gram station, making it much faster than a digital general purpose computer in solution of differential equations.

• Infrared

Corporation, Inc., for missile-to-aircraft communications using infrared instead of radio frequencies to provide greater speed and greater accuracy is being developed by North American Rockwell Corp. and Rockwell International Space Division.

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FILTER CENTER

to figures released by Commerce Department's Bureau of Defense Services Administration.

• Display Systems Bibliography

Released—An extensive bibliography of published publications on display techniques and systems, including human engineering studies and some previously classified reports, is listed in a 319-page book entitled "Display Systems," identified AD-365-912, now available from the Commerce Department, Office of Technical Services, Washington 25, D. C. Price is \$5.00.

• Signal on the Detached Line

Has been recently received by atomic management include:

• General Precision, Inc., GFP Division, will investigate use of laser in airborne and spaceborne tracking devices under a \$91,000 contract from USAF's Airborne Systems Division. The company's Leesburg Division reports a \$1-million ARD contract to build a strategic digital navigation equipment for the USAF's Lockheed C-141 transport.

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• Martin Co., Electronic Systems & Products Division, Bethesda—Contracted the Office of Naval Research for an infrared background discrimination study using the company-developed, multi-element infrared detector array.

The project is part of ONR's program to develop infrared sensor and detector arrays. The division also reports a \$15,000 contract from NASA to fabricate six infrared human sensors and power supplies for serving arrays of the second stage of the Saturn space booster.

URGENT:

PACK ONE MILLION COMPONENTS IN ONE CUBIC FOOT!



Shrinking the size of modern electronic gear to simplify the nation's work in space exploration gets top priority at Sylvania Electronic Systems.

Recently, our scientists developed a microminimatic module consisting of a series of circuit wafers, hermetically sealed. Each wafer contains many parts, and complex modules incorporate approximately 60 electronic components in only 93/1000ths of a cubic inch! Now we are rapidly approaching the day when more than one million individual components can be packed into one cubic foot!

How would such equipment perform in outer space? Laboratory tests show that circuitry employing Sylvania's microminimatic techniques can survive and perform satisfactorily for over 36,000 hours! What's more, these modules permit circuit stage interconnection without the use of wires!

Making advances that promote the nation's position in the race for space is just one of many areas of talent concentration among the scientists and engineers of the General Telephone & Electronics corporate family. The vast communications and electronics capabilities of GT&E, directed through Sylvania Electronic Systems, can research, design, produce, install, and service complete electronic systems. These systems cover the entire range from detection and tracking, electronic warfare, intelligence and reconnaissance through communications, data processing and display.

That is why we say—the many worlds of defense electronics meet at Sylvania Electronic Systems, a Division of Sylvania Electric Products Inc., 60 Sylvania Road, Waltham 54, Mass.

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You get pounds upon pounds per square inch of Adel's new size 3000 line Direct-Acting Control Valves. No valves are simpler or more versatile in design—with only one fifth the number of seals, one half the parts, space requirements and weight of similar valves with stainless bodies and steel components.

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specifications require. Our basic valve can vary to fit almost any fluid control system. And our standard steel valves, in 1/4, 1/2 and 1-1/2-inch sizes, work in systems of various fluids.

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Power Interruption Slashes Gyro Drift

Minneapolis-Honeywell has cut the drift rate of its magnetizing gyros over a range from 10.1 to as much as 42.8 in the simple technique of interrupting power flow to the gyro motor periodically in a precisely controlled mode.

The new approach, called gyro power interruption stabilization (SMIT), will be evaluated in Honeywell gyroscopes in the DynaStar line, called the X-230, G-230, G-230A and the SD-5 series. The company has applied for a patent on the idea.

The SMIT concept resulted from an investigation by Honeywell's St. Petersburg, Fla., research facility to discover why gyro drift increased in use shortly after they had been calibrated (tramped) to take out initial drift.

The researchers were then of two schools of the gyro error, but study of gyro returned from the field failed to disclose seek rate instability.

Drift Tests

Extensive tests at St. Petersburg revealed that drift occurred as a result of power interruption or insertion in the power supply. Interruptions occur during periodic startup and shutdown of the gyro during preliminary tests and also gyro are saturated from launch rate power to maneuver/boost rate power.

From these investigations came the idea, developed by British Farnborough and Whilham, 160, of intermittently interrupting the power to the gyro motor for precisely controlled intervals in precisely controlled cycles. Instead of aggravating the situation, this weaves out the random drift from this source, according to Farnborough.

Honeywell has tried a variety of different SMIT cycle times and has adopted the following as optimum for current gyro power on for 1.56 sec, followed by power off for 0.25 sec, followed by repetition of the cycle.

Platform Tests

To illustrate the improvement obtained through application of SMIT, Honeywell ran tests on stabilized platform in which gyro were run up and shut down a number of times, at this would be in normal use, and compared drift rates both with and without the new technique.

In one platform, maximum gyro drift rate experienced during 10 start up, shutdown operation was 0.44 deg per hour, or 1.6 deg/hr. Introducing SMIT with 1.56 sec. on, 0.25 sec. off, SMIT was employed. Another gyro after one start/stop, startup operation had a maximum drift rate of 0.15 deg/hr without SMIT, but a drift rate

of only 0.04 deg/hr when the new technique was used.

Still another gyro had an maximum drift rate slashed from 3.4 deg/hr to only 0.82 deg/hr when the new technique was employed, according to Honeywell.

Tests over the supposed stability domain from 0 to 300 deg/hr should eliminate the need for preburnish calibration for many applications, and eliminate related drift after launch despite transients in the initial power supply.

Additionally, Farnborough higher yield on gyro manufacturing operations because a major source of drift is eliminated.

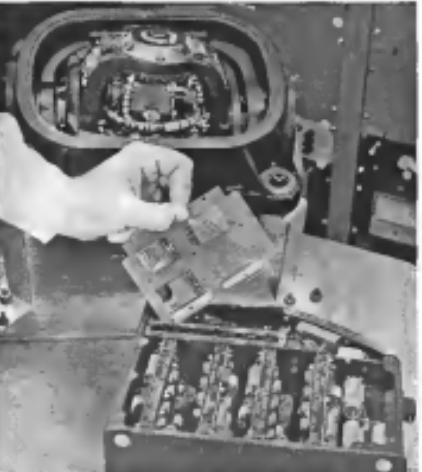
Principle of Operation

The basic mode of gyroscopic stability is given, and the explanation of the spin axis, the gyroscope's length, involves the fundamental principles of operation of the gyroscopic, Honeywell motor used to spin the gyro rotor.

In a horizontal motor, when the spinning rotor comes up in speed it magnetically loads into synchronism with the rotating field created by the rotor and will remain in resonance as long as there are no transients in power supply.

The rotating field produced by the three-phase motor winding, excited from the rotor (i.e., source), which is rotating at the frequency of the ac supply, although as stability is lost, the rotating field induces hysteresis currents in a steel ring and windings which line the stator circumference of the spinning rotor. The fields produced by these hysteresis currents react with the rotor field to cause the rotor to stop.

When the rotor is spinning at constant speed, the stator field produces magnetic poles in the hysteresis ring which are opposite the poles of the stator bar magnet. For example, as



GYRO DRIFT RATE has been reduced by factor of 10.1 to 40.1 by Honeywell using three small modules shown above which periodically interrupt power to gyro spin motors for precisely controlled intervals, averaging out effects of transients. The example on the left shows SMIT (gyro motor interruption technique).



New "TELSTAR" relays phone calls and TV pictures for first time!

Bell System microwave-in-sky satellite is latest communications triumph for America arising from telephone research

The world's first private enterprise communications satellite is now being used for dramatic experiments in relaying telephone calls and television internationally.

In name Telstar, it was launched from Cape Canaveral at Bell System expense by the National Aeronautics and Space Administration.

Telstar receives signals destined to it from a ground station, amplifies them and transmits them to another station on the ground below—perhaps an ocean away from the first one. The new satellite thus acts as a microwave relay station in the sky, enabling voice, TV pictures and data messages to leap thousands of miles in a new and exciting way.

The ground stations in the U.S. now being and due to follow were built by the Bell Systems at Andover, Maine, and Holmdel, New Jersey. Operations already started two light stations in England and France. The latter, a mere replica of the station in Maine, was assembled with Bell Systems cooperation. A receiving station in Italy will be ready late this year, and another in West Germany next year.

Telstar is a major experimental step toward a world-wide satellite communications system that was first proposed as a practical venture by Bell Telephone Laboratories. Progress toward such a system has depended on many contributions by the private communications industry, including six basic components—the transponder, the solar battery, the tracking system, tube, relay masses, the waveguide and the antenna. For the ground stations, much cooperation is necessary—direct outgrowth of Bell System research and development.

Above all else, Telstar is the latest achievement in an ongoing Bell System quest to develop ever better communications for both civilian and military applications.



BELL TELEPHONE SYSTEM

AMERIND TEL & TEL CO. / WESTERN ELECTRIC CO.
BELL TELEPHONE LABORATORIES / IN OPERATING BUREAUX

INQUIRIES: GROUND STATION "RADOME" AT ANDOVER, MAINE. BELL SYSTEM CLOUDS OVER THE EARTH AS SEEN BY THE LUNAR LANDER. THE LUNAR LANDER ALSO REPRESENTS EXTREMELY WELL AGAINST COLORING FROM BELL'S HEADQUARTERS (BELL'S BLDG. OF BLDGS.).



largely nullifies the effect of the previous vibration.

However, if the transponder drifts out of its center position, the motor will continue to rotate in the same direction, thereby causing the gyro to drift. The solution, as devised by Freret and Lee, was to intentionally force the gyro to rotate and flip through a complete revolution every 20 sec. so that the damped pulses would appear regularly around the motor periphery, thereby averaging out the drift for all such pulses.

This approach bears some similarity to the technique known as Rutherford devised by Sperry Gyroscope Co. to cope with gyro drifts in the SMIT ground system (AVN Feb. 27, 1968, p. 78). That involves the use of a small motor to rotate the entire mass of gyro and bearing in opposite directions with periodic reversal of direction. The unpredictable spurious pulses are thus applied briefly around the entire gyro assembly, first in one direction and then in another, to average them out.

However, the later design approach to SMIT has been to use a small transducer and switching device to remove excitation from one plane of the three-plane motor assembly. The 275-mil. sec. motor, after which power is again applied for approximately 3.56 sec. The SMIT circuitry for these gyro selection apparently 6 sec. to weight a low mass, not including the cycle timing clock. When the motor assembly uses a digital computer for computer purposes, its clock can be used to control the timing sequence.

A more sophisticated SMIT control technique, now under development, is expected to achieve more power for the motor, and to eliminate the power drift rate. It will do this by phase control, so that the phase of the current supplied to all three motor windings is 180° increments, thereby causing the motor to lock in precisely at 360° increments around the circumference, according to Freret.

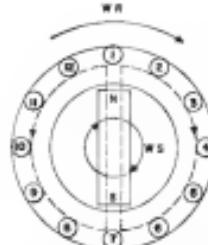
Midland Condition

If a ratio were perfectly homogeneous and perfectly balanced, and if its basic design were identical and perfectly balanced, it should make no difference where the new ratios occur. But in practice, these additional conditions are not to be achieved, so the problem can quickly lead to a fairly low total gyro torque.

The reason is that in the motor there is an unbalance of the rotor.

Even with a stable power supply source, slight changes in motor load can cause a slow drift or migration of the motor polar, producing a slow, long-term drift, called "creep." Freret says:

"That means that a gyro can be perfectly balanced during pre-launch calibration, not to take out drift, but when the gyro is switched down, bands tend to increase internal power source, the motor will lock in at a different position. This



SPIN MOTOR illustrates technique for dithering gyro drift. It is based on fact that rotating field produced by motor control induces polar at two points in surrounding rotor—(3) and (7) in example shown. One does rotations in clockwise or gyro power source acts to lock in at different points, causing shift of mass balance and drift.

is due to the unbalance, which the motor can correct in points (1) and (7) on the lower outer ring.

So long as there is no power source or load, points (1) and (7) will always be aligned with the direction of the rotating static field (line magnet). But if there is even a loss of load power such as switching over from branch load to main power supply, then the motor will hardly drop out of synchronism with the static field.

When power is restored, the motor will again return to synchronous speed, but when it locks into the static field again, the load, including the power source, will be at a different location. For example, they might be at points (9) and (3), or at (4) and (10).

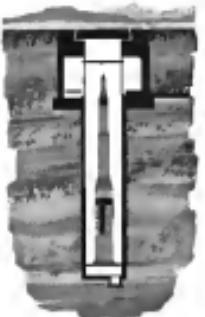
Midland Condition

If a ratio were perfectly homogeneous and perfectly balanced, and if its basic design were identical and perfectly balanced, it should make no difference where the new ratios occur. But in practice, these additional conditions are not to be achieved, so the problem can quickly lead to a fairly low total gyro torque.

The reason is that in the motor there is an unbalance of the rotor.

Even with a stable power supply source, slight changes in motor load can cause a slow drift or migration of the motor polar, producing a slow, long-term drift, called "creep." Freret says:

"That means that a gyro can be perfectly balanced during pre-launch calibration, not to take out drift, but when the gyro is switched down, bands tend to increase internal power source, the motor will lock in at a different position. This



for the Minuteman: Engineered Environment

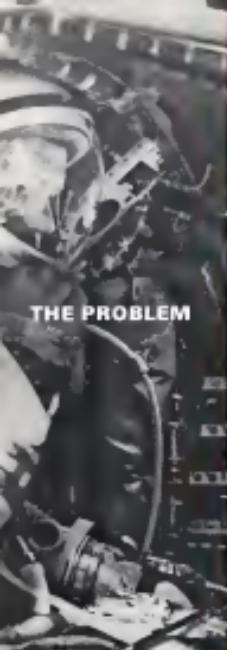
The limited underground sites of the USAF Minuteman present extreme environmental problems. Yet the missiles must remain operational continuously—ready to perform instantly at all times. Helping the Air Force meet this Reliability challenge, American Air Filter developed and is producing and installing the environmental Operational Ground Equipment required.

American Air Filter maintains a total capability to design and produce such environmental control systems—keeping current both in engineering know-how and in research, testing, and manufacturing facilities. For example, AAF has sustained compliance with Specifications MIL-R-27342, G-M-07-18-2617A, and S-133-2.

Our staff of capability helps solve essential environmental control problems for your defense products. American Air Filter Co., Inc., 270 Third Street, Rock Island, IL. Please 758-8311. Write for Bulletin 8-11.



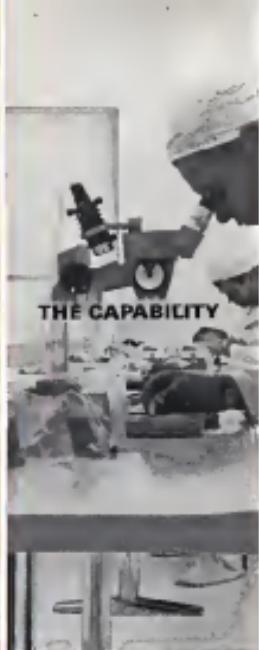
**ENGINEERED
ENVIRONMENTAL
SYSTEMS**



THE PROBLEM



THE HARDWARE



THE CAPABILITY

It takes an understanding of all 3 to build a hydraulic system

It takes system engineering experience. The solution to the problem may depend on hydraulics knowledge, but it is usually even restricted to that one engineering discipline. At Crane's Hydro-Aire Division, unique problem-solving experience is available in two ways. First, the engineering disciplines range from hydraulics to electro-mechanical, electronics and pneumatics. Second, there is continuous practice in combining these disciplines in system design. Recent outstanding example: the complex relationship of electronics and advanced hydraulics in our integral MARK II electronic brake torque control system.

A detailed report on our products, facilities and capabilities in advanced hydraulics has just been completed. May we send you a copy?



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HYDRO-AIRE DIVISION

FINANCIAL

Aerospace Industry Financial Results - 1961

Three-year comparative financial results are shown for major aerospace enterprises. Those in the avionics and aerospace equipment categories are only a small portion of those included in the industry, but are shown as an effort to show a valid comparative sampling of how sales break down for various types of systems as shown in accompanying table below. Real figures in \$ in millions indicate basis.

SALARIES (in millions)	SALES (in millions)			PROFIT (in millions)			BACKLOG (in millions)			PROFIT MARGIN SALES			PROFIT MARGIN NET WORTH		
	1961	1960	1959	1961	1960	1959	1961	1960	1959	1961	1960	1959	1961	1960	1959
AEROSPACE VEHICLES															
Boeing	1,000	1,047	1,008	326	324	317	145	145	136	1,000	1,000	1,000	1.4%	1.4%	1.3%
Convair	1,000	1,047	1,008	326	324	317	145	145	136	1,000	1,000	1,000	1.4%	1.4%	1.3%
General Dynamics	1,000	1,047	1,008	326	324	317	145	145	136	1,000	1,000	1,000	1.4%	1.4%	1.3%
Lockheed	1,000	1,047	1,008	326	324	317	145	145	136	1,000	1,000	1,000	1.4%	1.4%	1.3%
McDonnell	1,000	1,047	1,008	326	324	317	145	145	136	1,000	1,000	1,000	1.4%	1.4%	1.3%
North American	1,000	1,047	1,008	326	324	317	145	145	136	1,000	1,000	1,000	1.4%	1.4%	1.3%
Northrop	1,000	1,047	1,008	326	324	317	145	145	136	1,000	1,000	1,000	1.4%	1.4%	1.3%
Rockwell	1,000	1,047	1,008	326	324	317	145	145	136	1,000	1,000	1,000	1.4%	1.4%	1.3%
United Aircraft	1,000	1,047	1,008	326	324	317	145	145	136	1,000	1,000	1,000	1.4%	1.4%	1.3%
DEFENSE FL FLD															
Boeing	720	728	721	211	211	211	100	100	100	720	720	720	1.4%	1.4%	1.4%
Convair	167	177	171	44	44	44	21	21	21	167	167	167	1.2%	1.2%	1.2%
General Dynamics	167	177	171	44	44	44	21	21	21	167	167	167	1.2%	1.2%	1.2%
Lockheed	167	177	171	44	44	44	21	21	21	167	167	167	1.2%	1.2%	1.2%
McDonnell	167	177	171	44	44	44	21	21	21	167	167	167	1.2%	1.2%	1.2%
North American	167	177	171	44	44	44	21	21	21	167	167	167	1.2%	1.2%	1.2%
Northrop	167	177	171	44	44	44	21	21	21	167	167	167	1.2%	1.2%	1.2%
Rockwell	167	177	171	44	44	44	21	21	21	167	167	167	1.2%	1.2%	1.2%
United Aircraft	167	177	171	44	44	44	21	21	21	167	167	167	1.2%	1.2%	1.2%
ARMED AND SPACE EQUIPMENT															
Aviation Electronics & Power	100	107	101	30	30	30	15	15	15	100	100	100	1.5%	1.5%	1.5%
Boeing	100	107	101	30	30	30	15	15	15	100	100	100	1.5%	1.5%	1.5%
Convair	100	107	101	30	30	30	15	15	15	100	100	100	1.5%	1.5%	1.5%
General Dynamics	100	107	101	30	30	30	15	15	15	100	100	100	1.5%	1.5%	1.5%
Lockheed	100	107	101	30	30	30	15	15	15	100	100	100	1.5%	1.5%	1.5%
McDonnell	100	107	101	30	30	30	15	15	15	100	100	100	1.5%	1.5%	1.5%
North American	100	107	101	30	30	30	15	15	15	100	100	100	1.5%	1.5%	1.5%
Northrop	100	107	101	30	30	30	15	15	15	100	100	100	1.5%	1.5%	1.5%
Rockwell	100	107	101	30	30	30	15	15	15	100	100	100	1.5%	1.5%	1.5%
United Aircraft	100	107	101	30	30	30	15	15	15	100	100	100	1.5%	1.5%	1.5%
MANUFACTURING															
Boeing	100	107	101	30	30	30	15	15	15	100	100	100	1.5%	1.5%	1.5%
Convair	100	107	101	30	30	30	15	15	15	100	100	100	1.5%	1.5%	1.5%
General Dynamics	100	107	101	30	30	30	15	15	15	100	100	100	1.5%	1.5%	1.5%
Lockheed	100	107	101	30	30	30	15	15	15	100	100	100	1.5%	1.5%	1.5%
McDonnell	100	107	101	30	30	30	15	15	15	100	100	100	1.5%	1.5%	1.5%
North American	100	107	101	30	30	30	15	15	15	100	100	100	1.5%	1.5%	1.5%
Northrop	100	107	101	30	30	30	15	15	15	100	100	100	1.5%	1.5%	1.5%
Rockwell	100	107	101	30	30	30	15	15	15	100	100	100	1.5%	1.5%	1.5%
United Aircraft	100	107	101	30	30	30	15	15	15	100	100	100	1.5%	1.5%	1.5%
PRODUCTION															
Airframe	271	284	264	74	74	74	37	37	37	271	271	271	1.4%	1.4%	1.4%
Communication	100	107	101	30	30	30	15	15	15	100	100	100	1.5%	1.5%	1.5%
Computers	100	107	101	30	30	30	15	15	15	100	100	100	1.5%	1.5%	1.5%
Electronics	100	107	101	30	30	30	15	15	15	100	100	100	1.5%	1.5%	1.5%
Guided Missiles	100	107	101	30	30	30	15	15	15	100	100	100	1.5%	1.5%	1.5%
Instrumentation	100	107	101	30	30	30	15	15	15	100	100	100	1.5%	1.5%	1.5%
Missile Propulsion	100	107	101	30	30	30	15	15	15	100	100	100	1.5%	1.5%	1.5%
Space	100	107	101	30	30	30	15	15	15	100	100	100	1.5%	1.5%	1.5%
Transportation	100	107	101	30	30	30	15	15	15	100	100	100	1.5%	1.5%	1.5%
Water	100	107	101	30	30	30	15	15	15	100	100	100	1.5%	1.5%	1.5%
PRODUCTION EQUIPMENT															
Boeing	100	107	101	30	30	30	15	15	15	100	100	100	1.5%	1.5%	1.5%
Convair	100	107	101	30	30	30	15	15	15	100	100	100	1.5%	1.5%	1.5%
General Dynamics	100	107	101	30	30	30	15	15	15	100	100	100	1.5%	1.5%	1.5%
Lockheed	100	107	101	30	30	30	15	15	15	100	100	100	1.5%	1.5%	1.5%
McDonnell	100	107	101	30	30	30	15	15	15	100	100	100	1.5%	1.5%	1.5%
North American	100	107	101	30	30	30	15	15	15	100	100	100	1.5%	1.5%	1.5%
Northrop	100	107	101	30	30	30	15	15	15	100	100	100	1.5%	1.5%	1.5%
Rockwell	100	107	101	30	30	30	15	15	15	100	100	100	1.5%	1.5%	1.5%
United Aircraft	100	107	101	30	30	30	15	15	15	100	100	100	1.5%	1.5%	1.5%

1. Includes sales to Defense Contract Manager. Previous years not consolidated and are not included in 1961. 2. Includes 1961 sales of 1960 sales 20% of 1960. 3. Includes Defense sales of 1961. 4. Includes 1961 sales of 1960 sales 20% of 1960. 5. Includes 1961 sales of 1960 sales 20% of 1960. 6. Includes 1961 sales of 1960 sales 20% of 1960. 7. Includes 1961 sales of 1960 sales 20% of 1960. 8. Includes 1961 sales of 1960 sales 20% of 1960. 9. Includes 1961 sales of 1960 sales 20% of 1960. 10. Includes 1961 sales of 1960 sales 20% of 1960. 11. Includes 1961 sales of 1960 sales 20% of 1960. 12. Includes 1961 sales of 1960 sales 20% of 1960. 13. Includes 1961 sales of 1960 sales 20% of 1960. 14. Includes 1961 sales of 1960 sales 20% of 1960. 15. Includes 1961 sales of 1960 sales 20% of 1960. 16. Includes 1961 sales of 1960 sales 20% of 1960. 17. Includes 1961 sales of 1960 sales 20% of 1960. 18. Includes 1961 sales of 1960 sales 20% of 1960. 19. 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DE HAVILLAND DH-125, first model of which was rolled out July 23, is designed primarily as a single, cabin aircraft short-haul transport or an executive jet transport and a military trainer and administrative transport.

DH-125 Faces U.S., French Competition

By Herbert J. Calomme

London—De Havilland Aircraft, facing active competition in the world's executive jet market, rolled out its DH-125 all-metal twin-jet transport July 23, the first of a total batch of 10.

The seaplane has been promised, according to officials, and investors. British results reflect that there are no initial announcements, except design and construction methods.

In this field the DH-125 faces heavy competition from the North American T-39 transport aircraft, which has been in production since 1962. On the basis of Havilland executives insist that, in the civil version, its prime competitor will come from the Beechcraft Model 18 and, they say, this plane is still in the mockup stage.

Major DH-125 features include:

• Customer price of \$400,000 in the standard version and about \$75,000 more for radio and radar gear.

• Large cabin and luggage area which, it is probably, will be the main pro-

vider to the Royal Air Force, now planning the purchase of about 10 aircraft in various internal configurations.

The deal is believed to be near consummation, with final down-to-component parts and placement.

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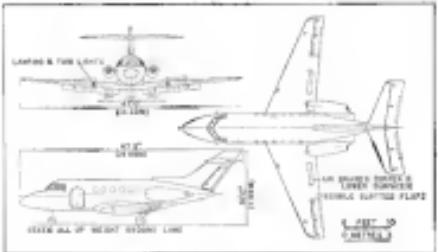
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THREE-VIEW shows engineering design specifications of the DH-125 transport.

cessful orders for the DH-125 have already been booked.

He told *AVIATION WEEK* the airplane probably will make its first flight in mid-August to ensure its participation in the annual Society of British Aircraft Constructors Show at Farnborough Sept. 3-10. Airplane must have flown 10 hr. to qualify for Farnborough show; test pilot will be Chris Cooper, assisted in the night test by Geoffry Pidde.

Initial orders will be certificates under Air Registration Board aircraft new sales, and Sir Aubrey said the airplane will be suitable for fast transport services.

Certification for U.S. requirements will be made under CAR Part 16, up to the air transport category. The latter achievement will give de Havilland a competitive edge over other jet executive planes now in the Part 16 subcategory but with an accompanying restriction.

At the moment, however, de Havilland is not pushing the DH-125 too strongly as a先驱者 for the obvious reason that it does not believe it needs to be an all-purpose jet in the field yet to realize "Certification to fall or freeze out" in some as expansion of

company confidence in the airplane's ability to fill a worthwhile role.

The DH-125 went into the drawing board in April 1964, based on the 30-passenger batch program and has undergone five design changes since that date. Main reason for hasty timeline point and design work on the de Havilland was late, a desire that used considerable expense in development of the Trident transport transport now flying (AWW May 18, p. 187).

When de Havilland first decided to go ahead to get executive field, the DH-125 was a six-passenger airplane, with a 43.5 ft. overall length, a wingspan of 44 ft. and a gross weight of 15,000 lb. But market survey, along with cost estimate based as seating drawing, resulted in the slightly larger replacement fuselage for production. New length is 47 ft. 5 in.; wingspan is 47 ft. and gross weight increased to 19,000 lb.

One mark of executive field along with word model testing of models was to increase the size of the vertical stabilizer to about 5 in. to a new height of ground to tip of 16 ft. The new increased downwash stability at both high and low speed regimes.

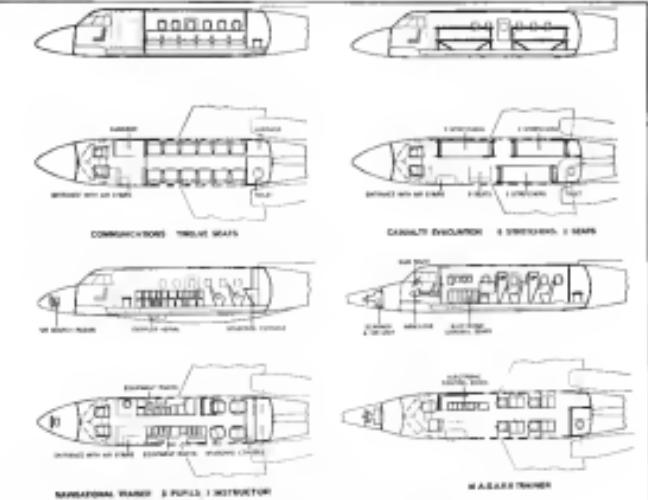
Another design decision was to

move the forward 1 ft. in to 47 ft. 5 in. to provide the larger forward compartment and to allow the forward passenger door to be lowered. First two airplanes will have the narrow door but production version will be built with the larger one. Another feature is that the door cannot extend, sliding around the top, forehead on side. Airframe is hydroformed and lowered from a roll.

For additional stability, de Havilland has designed a smaller pressure bulkhead in the forward section which can be fitted to customer specification.

Another that is likely to have three-type-one, two and one. "Wing is a low single and fixed to the center fuselage, with the center section passing under the belly and terminating the nose for a nose up to pass through the cabin floor. Another reason was to increase the nose fuel storage area, the wing is virtually an entire tank, bolted into five sections to avoid cracking. Perch is to gravity to two pumps in the center section and fuel manifold and fuel transfer pipelines have been made. The DH-125 carries a 1,000-lb. gas, or 3,300 lb. of fuel.

De Havilland has not revealed struc-



SCHEMATIC DRAWINGS indicate various internal configurations of the DH-125 which de Havilland plans to offer.

VASCOMAX 250 AIR or 300 GVM

MARAGING STEELS up to 300,000 psi yield!

with remarkable
DUCTILITY
when hardened!



A—Machinability: yield at 100% of yield strength, 100 rpm, 0.4% G—Heat treat: 1000°F, 1 hr, air cool; 1200°F, 1 hr, oil cool. B—Welding: 200°F, 1 hr, 100% of yield strength.

These Vascomax test specimens from our Research Laboratory—oil worked in the hardened condition—demonstrate ductility beyond all expectations for ultra high strength steels. But Vascomax 250 and 300 Maraging Steels are equally remarkable in notch toughness—capable of high strength with minimum ductile-to-brittle brittleness. Available (with our Vascomax 200-W and 300-W welding wire)—freedom in

machining—and simple heat treating to 54 Rc. You can obtain Vascomax 250 air or Commercial Vacuum Melting, or Vascomax 300 Commercial Vacuum Melting in all customary forms and sizes. In any shape, we may buy it, form it, heat it, cool it, form it, heat it, cool it, and weld it. **AND YOU'RE READY TO GO!** Write for Data Sheets. Information on other compositions of Maraging Steels also gladly furnished on request.

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Divisions: Anchor Steel Co. • Chromel Steel Co. • Metal Casting Company • Pittsburgh Tool Steel Wire Co.

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FIRST QUALITY
SINCE 1910

test changes in an instant version when the NASAIR transonic wind tunnel is being built at the Hillfield production plant. This involves considerable strain in the nose section to hold the sensor and related atomic equipment. Otherwise, the supersonic remains virtual in the nose externally.

One-Pilot Cockpit

Depending on customer requirements, de Havilland also will offer the aircraft in military and civil versions with a one-pilot cockpit layout.

Wing leading edge camtrusion gross weight is 53.8 lb/sq ft, and gross weight when rotated to 45° is 60.8 lb/sq ft. With a fixed wing, gross weight is 1,000 lb, and the center section of each wing is braced to the fuselage. The pilot is provided with an ejection control on the nose console.

The Havilland is predicting D31-425 overall performance on a lateral operating speed (V_L) of 290 ft below 35,000 ft. Above the altitude, aircraft speed will be Mach 0.735. Design cruise speed (V_c) is 167 ft below 31,000 ft and Mach 0.825 above that altitude.

Maximum gross weight is 19,000 lb and landing weight is 17,200 lb. In instant configuration with payload computed at 1,000 lb, the visual flight rate range would be 3,600 feet per second, the landing long-range range is 36,000 ft, and the first landing is 45 minutes.

Weight breakdown, using the instant configuration, is structure, 4,590 lb; two Viper 520s, 1,900 lb; fuel system, 193 lb; sensors, 1,417 lb; safety devices, including safety pens, 152 lb; airframe, including right canopy, 149 lb; fairings of cockpit, cabin and inlet, 485 lb; and payload pods, 160 lb., for a total empty weight of 8,000 lb. Optional items, such as radios and remote seat catapults would boost empty weight another 500 lb.

Particularized System
Research behind the aircraft and the plant's development, according to Tarry, is that the company is now considering private interests to complement government funds. The firm is organized as a government-owned and operated corporation, but a right-time cost budget plus studies indicating that a private investment potential could be realized, has led to the consideration. The firm, however, private investment would be substantial, immediately as the expected fields could come from American investors. According to Tarry, research has indicated that the potential is inherent both ways.

The company's target date for an infusion in mid-1963 with deliveries following in the last quarter of that year. Mass production will be concentrated at Haworthia Airport, near Chester, although the prototype is built at Hillfield, the site of the Trident and Concorde production lines. A second prototype, now well advanced and with wings mounted to main landing gear, is scheduled to fly in October.

The first aircraft will be used mainly for configuration testing. Several prototypes will be used to help build up the aircraft's performance. The first four aircraft will be built at Bristol Sodeley's Filton plant.

Israel Aircraft Considers Private Financing for B-101C Development

By Arnold Sherman

New York-based Aircraft Industries, at Lod, Israel, will soon develop the B-101C strategic executive aircraft that is now, according to an official of the company.

Stiff international competition in the executive jet market, for the moment, will not permit expansion of the project, but the firm, led to a statement of aircraft designer, will proceed with design of a prototype configuration of the aircraft, a prototype model of which was on display at Israel's Lod Airport facility (AVN Apr. 19, 1963), in 1963, will doubleback to design some modification, but the basic design will probably remain the same, according to Director of Personnel and Administration Zviros Tarry.

Israel Aircraft management decided to cancel development of the in-transit place transport last October. At that time the company insisted that the reasons for the cancellation was that design costs were too costly to make the aircraft the aircraft to meet its original objectives. The world market for aircraft, the potential range and speed of the plane, The P-100, the BAC 1-11 and the D31-425 were all aimed at the same market. Tight governmental price changes added to the dilemma.

Basic reason behind cancellation of the plant's development, according to Tarry, is that the company is now considering private interests to complement government funds. The firm is organized as a government-owned and operated corporation, but a right-time cost budget plus studies indicating that a private investment potential could be realized, has led to the consideration. The firm, however, private investment would be substantial, immediately as the expected fields could come from American investors. According to Tarry, research has indicated that the potential is inherent both ways.

Israel Aircraft has its future involved in the best interest both of its

• Improved aircraft in Africa and Asia. Tarry stated that the firm is seeking an aircraft to reflect the importance of the newly emerging nations in Africa and Asia. Tarry pointed out that while at the moment there is very little business potential for his firm in these nations, his country anticipates that in these countries, geographically and economically, Israel's geography and competitive cost factors will stand in good stead.

• Peace with the Arabs. Tarry stressed that at his talk in 1961, a year before the official creation of Israel Aircraft Industries, the company's goal was related to eventual peace with the oil-rich Arab nations. "We must realize that Arab nations, for the Israeli's best interests, U.S. and European engines, perhaps overhauled and modified, will do for the air forces of Portugal, France, Germany and Brazil. Israel Aircraft also hopes to have countermeasures with the Air Forces, TWA, BOAC, RIA,

Alitalia, Swissair and Olympic Airways.

Major facility enlargements and increased aircraft handling accommodations are planned by the firm which now employs 3,300 people. The new design shop area is to be expanded and the construction of an additional large hangar to handle added aircraft maintenance projects is planned. The engine shop will be enlarged to facilitate handling of Pratt & Whitney Avon 4, Avon 9 and Rolls-Royce Conway engines.

In line with the firm's growth and potential Israel has sent Tarry to the United States to recruit the technical and professional personnel which, according to the Israeli executive, are lacking domestically.

Tarry said first Israel Aircraft spends roughly 10% of its overall budget on technical training for its personnel but departs that a critical shortage of skilled engineers.

Part of the problem appears to be that a significant percentage of the engineers and technicians come from African countries and few of these immigrants enter Israel with any technical or professional knowledge.

Years and that lack of technically capable personnel has been a major pacifying item in the growth of the company. "If it is at all possible," Tarry said, "we intend to recruit the personnel we need in the United States, Canada and Europe." Tarry said that to date "considerable interest has been shown by the American engineers he has contacted."

Israel Aircraft sees its future involved in the best interest both of its

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Private Aircraft Sales Show Spotty Rise

By Lewis J. Balfour

Dulles, Va.—Business aircraft remain in a recession in the first half of Calendar 1962 but not as bad as last year. Total sales and total dollar values are black. In excess of last year, but the situation probably looks worse for some companies and all are not sure in that regard.

All indications point towards Cessna leading the field this year in units delivered and dollar volume by a healthy margin. Beech and Aeronca/Comanche are less optimistic than they were earlier this year and Mooney is showing an increase in both units delivered and dollar volume.

Part of the sluggishness is attributed by some companies to the Administration's so-called high altitude lending ban and part to the recent sharp decline in the stock market. The latter this year has not only reduced consumer interest, but rather has a sharper impact on distributors who rather than pass losses on to the purchasing customer, who feels that their capital position is such that they should cancel inventories.

As a result factory personnel find themselves working hard with field sales outlets using their distribution and dealers to take advantage of any momentum created by the consumption slow down in efforts, while those experiencing a decline are out trying to prevent this from happening.

Most optimistic of the big companies is Cessna Marketing Division Manager Frank Martin. He feels that the company will do about 100 better in dollar value than last year but from a unit delivery rating of 54.57 million higher. Although he said American Wings that he thinks units delivered might only be a factor higher than last year, indications are that if the company's rate of sales continues at the pace shown so far, Cessna will have to



JetStar Demonstrated at Reading Air Show

Lockheed JetStar executes low-level flybys at the Reading, Pa., Air Show. More than 600 aircraft ranging in size from small Piper Cubs to Boeing 727s crowded the airport's grassy fields over during the event.

increase production rates in plant workers' demands for new airplanes.

Martin noted that although all figures have not yet been fully tallied, it appears that though down from this year, Cessna will have accounted for approximately 48% of units delivered by when it considers the major companies—Aero, Comanche, Beech, Cessna, Mooney and Piper.

Those within the Mooney organization feel that Cessna had delivered 322.5 million total units, or single-engine business planes, amounting to 39.6% of the market in the multi-engine market, the company, in the same period, gained 24.4% of the total business, or accounting for 53.5 million in sales. In both areas, according to Cessna, these totals exceed those of the year proved last year, with its percentage of dollar volume being up more than four points in the single-engine types, and nearly in the multi-engine segment, for an increase of \$4.4 million and nearly \$7 million, respectively.

Mooney views total business plane sales with the same concern in mind, although though its business has been down about 5.5%, factory sales force members are being sent out on the field to keep down on contributions and dealers and pass them to boost sales efforts and place orders with the factory. In demonstrations, Beech claims as field demonstrators are down substantially, as far as the factory is concerned, they should be with the result that this should be part of considerable concern at the factory, where efforts are made that all options are sold on the basis of taking the parts put up and demonstrating the field use, rather than selling them as options. According to Al Frank, Headley, Beech executive vice president, part of the decline is due to the fact that some dealers still want to do business as brokers.

Beech is working hard to enlarge its distributor dealer organization, but a major bottleneck exists in this field be-

cause of the lack of experienced sales personnel. It hopes to accelerate the process with introduction of an acre franchise \$15,500. Mooney, this fall, which because of its price, should enable new dealers to join the Beech organization that have been unable to come in because of the cost of inventory units in the company's flight price point.

The company's marketing campaign has had the Mooney, areas of potential dollar profits.

Aero, Comanche, indicates similar disappointment over the rate of business this first half and feels, although it has not been up to expectations in the past, as, another. Comanche spokesman feel that even if its distributor has been shaken by the turn of the tide in its segment of the market look during the big slide, and are waiting for estimates to come and see these. The factors in understanding several reasons to spur business—but notes that actually, this is doing the job as its tributes should be doing, without the assistance of its factory sales force and distributor personnel. In the distributor's area to work with customer prospects, and opening sales offices, staffed by factory personnel in areas of facts should be served. Recently, the company opened such an office at Wichita (Kan.) Municipal Airport and plans further expansion of the effort, to fill gaps it feels the distributor are neglecting, or where it is not covered.

The industry, generally, is working continued gains in exports, although business probably will not show the same rate of increase in the past year. Changes in that area are not due so much to a decrease in imports on the part of the U.S. as the world's shift in geographic market patterns—what was a good market one year, suddenly becomes a poor one the next because of changing dollar exchange problems and local political upsurges.

Jack Zuck, Cessna resort manager, reports that generally the company's international business is the best he's seen in the last 10 years. The car sales letter this \$6.5 million this year, compared with just under \$4.5 million the same period last year and the division's projected delivery of 62 units in June 13 is ahead of the same time last year. Sales of five-engine aircraft are up substantially with 41 sold in the first half of 1962 compared with only 9 last year in this period.

The company expects to increase its foreign market in the coming period to 10% year, particularly, since it has good distributor representation in that area. It has 310G or Skidhogs from Australia to France, Denmark, Sweden, Israel, Germany, England, Norway and Sweden and this needs participated in a major showing in the Swedish distributor, Solberg Cessna Flug A.B., in Stockholm. The distributor purchased 15 acre airplanes for static displays and overall aircraft sales dollars.

South American Market

In the South American market, the political situation has slowed operations somewhat, although Zuck believes it should be back to 1961 levels. Brazil and Mexico, which apparently in the slow markets earlier this year, look much more favorable, and he expects sales in those two countries to be up 15-20% over 1961. African market appears favorable in 1962 and Cessna has seen there should be up 25%, while Australia should show a 15% increase. New Zealand seems on the verge of 140,000 local dollar maturation, and when this occurs will have about 10 imports for 15 months, demand is expected to be high. The Philippines put a 100G demonstrator into Manila early this year and the distributor there already has taken or ordered 10 more. This type of sales pattern since the time of the Korean War.

The company also has expanded its dealer representation abroad. In addition to the Philippines, it has established direct factory sales outlets in Malaya, Liberia, Angola and Spain.

Streich also exports aircraft—business aircraft exports to be up 5% or 10% providing no backlog of \$11 million in 1962—with major schools in Europe, the Middle and Far East. South America has reported a larger percentage increase of foreign business plane sales as expected to come in the For East Asia.

The company has arranged an Export Exporters Association, taking 200 direct distribution in the Scandinavian, Belgian and American areas and seeking their dealership under Trans Air, Garde, Bremen, Germany, and extending Trans Air's function to cover France, Italy and North Africa.

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Photograph shows a safety head with full threaded opening for quick-actuated or overpressure protection.



The safety head shows here is the low nitrogen protects against over pressure in a missile's hydraulic system.



Photograph disc valve as a quick opening valve in the nozzle of "Jato Botta"—protecting thrust until the propellant develops a specified pressure.



Large diameter (in this case 24") Safety heads are fitted in a manifold to provide over pressure protection on this engine test chamber.

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Antonov Criticizes Soviet 'Quota' System

(Soviet aircraft designer O. K. Antonov has emerged in the last year as a leading spokesman for improvements in the overall Soviet industrial system—especially in respect to quota. His own series of two separate articles in *Aviation* point largely to greater efficiency in the Soviet system. The first, dated in March of this year, was directed at the use of aircraft quota. In the light of a recent petition presented along this line by Grunau Aviaco with its Il-10 (AVW Dec. 16, 1963, p. 18), it is possible to correlate other parallel key points from the articles below, and the box on page 75 deals with an other Antonov criticism, this one concerned with Soviet amateurish engineering education.)

What struck me most when work—and work!—it seems to me that all standards—both moral and material—should, on the basis of their effects, be divided into three main groups:

The most important standards, in my opinion, relate to the first group. This is the group whose members, growing alongside consciousness of Soviet man, his desire to serve society, the man need to work which can not easily subdue him already breed even less.

In the second group of standards I would place discipline, the feeling of responsibility, the desire to serve the plan, schedule or instructions of one's superiors or of an organization's higher management.

Self-interest

In the third group of standards one should place driver, material and technical standards, as determined by piece-rate wages or a percentage of the cost of production or other forms of remuneration.

Strengths of the first group operate correctly and naturally in accordance with the interests of society because they are engendered by an understanding of these interests. But, unfortunately, one needn't go very far to meet up with the same standards in the second and third groups. These standards are not exceptional in character.

The criteria for plan fulfillment and the methods used in determining extra reward for work can sometimes lead to entirely unexpected results when there is a poor choice of control "indicators." Such faulty "indicators" make some people act against their interests and, to some degree, even against the interests of society as a whole.

These "indicators" encourage people

to be wasteful, to manifest an economic attitude toward socialist property, and to expand working time and materials budgets.

Recently, I was walking along Monastyr's Belitskaya Mtselka. I stopped to look for which two materials gave such amazing results for construction of an apartment house. Actually the term "wasteful" is hardly applicable in this case.

They simply threw the bricks on the ground in a large, disorderly pile. I estimated that about 30% of the bricks were broken in this process.

Over-simplified instructions

The simplest become the workers' instructions were over-simplified. They were just told to build the tank in a tank in parallel. Probably the guys were told to be less while the truck driver was paid a wage plus a bonus per ton of bricks bought or, possibly, according to the number of kilotonnes he drove. They did. In addition, they were well-qualified not to have as to fall to the "plan."

In all these cases work was evaluated by some sort of short-cut method that are distant from the realities of life and from the ultimate usefulness of the tank in hand.

If these two go hand in hand,

then the tank trip to the construction project brings only 75% of the whole tanks loaded at the factory. Multiply 0.7 by six—the number of engines and we get 4.2 track loads a day. This is the number of whole tanks actually delivered to the construction project.

Alternative Cited

Now imagine that the guys manufacture the tanks in a strict pile and the breakage is reduced to 10%. Multiplying 0.9 by five loads and you get 4.5 track loads of whole tanks. At the same time, the number of good tanks is increased. In addition, an entire track load of bricks will remain at the tank plant. Such things will also be saved in tank fuel and depreciation, making it possible to increase the wages of both the god workers and the tank drivers.

In this sort of work organizations are needed? Yes, it is. But the trouble is that such reasonable criteria for calculating various types of production activity, while clearly beneficial for society as a whole, sometimes lead to a reduction in "gross output" and, consequently, to

an apparent drop in the work tempo.

That is what many earn who prevents the State Planning Commission, economic council and industrial plants from shifting over to new and more progressive methods which obviously could improve workers' work and accelerate the movement forward toward communism. Thus, the economic council would be able to explain to the rank-and-file State Planning Commission why project designs should be changed.

Thus, the All-USSR State Planning Commission would,

so here, have to explain to the USSR's State Planning Commission, etc., etc.

The situation is sometimes the same with regard to improving product quality. It happens like this. You increase quality and too decrease output. And even though the increased quality is very profitable to the state, a plant will, with the bleeding of the economic costs of, aim for gross output. Unknown quality is still one of the main indices of plan fulfillment and the plan is a matter of honor for the plant's management and director. Thus, the plant's planned losses, as a rule, a material interest in the coming losses impose because of the maximum output because of the maximum gross output losses.

Let us take a simple example:

• A factory makes aircraft engines which can operate 1,500 hr. before com-
plete reconditioning.

• One hour is required to make an engine with a service life of 3,000 hr. which would require not twice as many, but only 20% more hours of work.

From us, despite the obvious advantage of making a better quality product an economic reward and the aircraft engine factory will do that on its own merit. Consequently, you will be told to fall by 20%.

There is only one way to eliminate that contradiction, and that is to change over to use some progressive criterion for calculating a factory's work. After all, what is important is not the number of engines built—but by itself and updated from their quality and service life—but the total number of hours they will operate in the engines.

If a factory's work is evaluated as ending at 2000 hours, then the changeover to a new and more labor-consuming type of engine would be profitable not only to the state in a whole but also to the factory itself using the engine.

If, instead, we assume that a factory makes a thousand all-type engines per year, then their total service life will be 1,500 hours, 1,800, or 1,500 more hours.

Suppose, now, that the factory changes over to the new engine having a 3,000 hr. service life but also requires 20% more man-hours to build. In this instance, the engines produced

'Book Learning' Engineers

(Based on comments on industrial efficiency, Soviet designer O. K. Antonov also has opinions not agreed with some facets of Soviet educational engineering education. Major parts of his comments follow.)

There was no vocational training in the city where I completed secondary school. I had to wait as the university's railroad and highway department so that in due course, I would get the chance to move closer to aviation. However, the railroad and highway department was soon discontinued. For two years I had to wait in other universities—yet more difficult than that now. In the meantime, some friends and I built a glider of our design and took it to the All-USSR Glider Meet at Kirovograd. True, on our own initiative, we first had to acquire an understanding of aircraft strength and aerodynamics and this had to learn to be competent and mechanics.

Then when I was studying at the Kirovograd Polytechnic Institute our student group managed to build five gliders of various designs. At a competition, I easily won first prize without preparation. On the other hand, I just learned to fly on the gliders which I had built. I did not need this. This simply had to do with the fact that, however educational value there was in flying. And as it was... We studied what was essential and at the same time we mastered many practical skills. But now, this is almost impossible for students to build not only a glider but even simple structures. Doesn't this lack of opportunity to engage in creative labor become the enormous obstacle overhauled model as bookish-type students who become engineers for route learning?

How many preparatory hours, for example, are thrown up in honor of students trying to build small simple airplanes of their own design? Here the college authorities advance claims of justified reasons why such a project should not be undertaken. Won't it interfere with studies? Who will be responsible if there is an accident? And so on, and so forth.

On the basis of many years of experience, I know: No, it won't interfere with studies! We must not only permit but encourage and support every kind of creative activities in this direction. We must not think that such work detracts from their studies. Building even a small toy airplane by their own efforts will provide direct experience and schooling that cannot be replaced by books or by "presenting" a pilot's manual specifically designed for beginners. It will give them all-around knowledge and the opportunity to obtain an overall first-hand engineering education, which consists of a wide variety of complex problems.

Building of a light airplane or military sputnik doesn't cost much. It is 10 to 20 times less expensive than ordered at a factory. And a pilot would cost still less. Furthermore, such construction can be conducted in all or part with the academic process, with laboratory work and with research.

The Kirovograd Aviation Institute is one of the most advanced in the nation. But even there they have long taught flight tests of a light plane built by students. At a result the students complain, although hardly knowing how to do, decided to test the airplane themselves. It was determined. The terrible disaster and the loss built another airplane. This time not enough! It and the workshop at night and tested it at the bottom of a ravine. And, of course, the result was the same. How much more useful the tests would have been if the institute had taken a more active part in this. If there was who knew about this project but not built afraid of what the director would say, and if there had not just a spoke in the wheel.

As for the other, present, practice of training students in the laboratory, I am entirely sure of the following: The present practice is wrong and has no basis for the future. Presently, in 1958, students in all parts of the country build lots of gliders and airplanes. Architects were very interested, and even these took place mostly when, instead of running help and cooperation, the students were hampered in their work and had unnecessary obstacles put in their way. Since then we have made great strides technically. We have become more and more competent and advanced. Why, then, are we not afraid of initiative and increased creativity? If a college is capable to guarantee the stability, reliability and structural strength of a small airplane or glider built in its workshop, then how can it graduate so meekly engineers?

The problem must be put more broadly. Students must build not only airplanes and planes but also automobile engines, hydroelectric boats, rockets, calculating machines, solar equipment, small engines, and many other things.

If we help students in the right way to prepare themselves for creative work, I believe that the number of well-educated, who honestly "put" men will decline sharply. And the number of people who love their work passionately—in the past of achievement—will inevitably increase. It will then become simply impossible to evaluate a student's "progress" by his grades alone.



O. K. ANTONOV

INTERNATIONAL AIR TRANSPORTATION ISSUE

SEPTEMBER 10, 1962

The impact and challenge of recent trends and developments in international air transportation will be the subject of AVIATION WEEK & SPACE TECHNOLOGY's International Air Transportation Issue, September 10, 1962.

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index of each plant must be the national benefit—the effect on the national resources which accrue to the state in an overall basis when the production of a given factor is increased.

To do this it is necessary to evaluate monetarily the categories of quantity and quality. In such case, the contributions, direct or indirect, to the state are merely well-solved goals in both quality and quantity of production in the national economy as a whole.

The logical connection between quantity and quality must be such that when changing over to manufacture of higher quality products, the state is made to benefit and the question we merely will solve goals in both quality and quantity of production in the national economy as a whole.

Reciprocal Connection

Remember next we study that under old social and economic structures, which developed spontaneously over a long period of time, a so-called reciprocal connection was easily evaded. Without this connection there can never be smooth things could not exist.

Then, for example, in the review of capitalist production the role of reciprocal connection is played by selling, the function of the bourgeoisie. In these factors that force the capitalist to make things better, more producible and cheaper.

Under our socialist conditions—in an economy, system built by society according to the laws of reason—the reciprocal connection must also be created through reason. This must be well thought out and must be in the right sequence.

The textile industry not only is not making but, in the review, is destroying 85% output of fabrics which have not had no market for a long time. Such existence is possible only because a monopoly economic connection is completely broken. The textile factory does not know its market and is not interested in the selling of its products. It does not even think to find marketing organization and doesn't give a long about marketing site. The State Bank does not interest in the Japanese foreign, for procurement of raw materials, and for other expense. And so it is possible to keep on working not for the sales counter but for the warehouse.

That is why the warehouse owners are breaking off goods entering into the market of products which have no market. This is the same established methods cannot obtain necessary material, techniques and semi-finished materials from their suppliers and the same cannot obtain clothing and shoes in the latest fashion and colors.

The influence of managers on their suppliers and as their production plus is extremely limited in our economy



Vibration Dampers Installed on F-27F

Vibration dampers, designed and installed by Martin-Baker and Inter-Amatics of Ft. Worth, Tex., are used aboard Fairchild F-27F. A total of 72 dampers, consisting of single bungee with two tip masses, are installed on various parts around the main fuselage frame.

Yet the nation-wide planning organization and those in each Soviet republic are able to plan the work of each factory in liaison with all the rest of the factories. This is a task that is still beyond their power in fact.

The existing methods of planning frequently lead to paralyzation of the basic figures of the plan and this inevitably leads to a situation wherein we freeze from tomorrow. The figures are, as a rule, achieved by a decree affecting the work of other establishments which are the recipients of products in future years. The figures are not whole, bearing the work of industry, whole and do not affect the major of future.

Examples of such freezing from the frozen in the paralyzation of a planful filling figure are, for instance, still finds in the results of economic with regard to agriculture.

The changeover to computing the work of industry by new, more progressive and more complex indices which

PERT/Cost Handbook

Washington—A handbook detailing

new methods of PERT/Cost pro-

cedures recently adopted by Defense De-

partment and the National Aeronautics and

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1961, is expected to be released from the

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15,000 copies are being printed at an esti-

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WHO'S WHERE

(Continued from page II)

Walter E. Bratton, chief, Airport Traffic Control Project at the Federal Aviation Agency's New York International Airport.

William J. Koch, general manager, Aerospace and Control Products Section of General Electric Co.'s Logistic Military Electronics Department, Johnson City, N.Y., succeeded on May 11, 1970, James AM. Fazio, Jr., p. 62.

Brian R. Custer, supervisor, contract requirements, Westinghouse Defense Contractor, Systems Management Department, Baltimore, Md.

Dr. John E. Rausch has joined the Technical Staff of National Engineering Service Co., Pasadena, Calif., as Dr. Steve Walker has left the company.

Kenneth W. Park, director of quality control, Electronics Operations, Avco Corp.'s Electronics and Guidance Division, Weymouth, Mass.

George Miller, chief engineer, instruments, and **Robert L. Lovell**, chief engineer, space, Western Instruments Division, El Cajon, Calif.

Dr. Carroll L. Zimmerman has joined the Douglas Missile and Space Systems Division, Santa Monica, Calif., as assistant to the Division vice president director of production.

Col. David B. Coffin has replaced Col. Charles A. Boies, retired, as Air Force Flight Test Center information chief, Edwards AFB, Calif.

Alfred B. Sowles, director of design, Avco Avionics, Inc., succeeded Karl S. Borch.

Charles F. Thomas, manager of marketing, International Defense Programs, Reliance Corp. of America's Defense Electronic Products Group, Linden, N.J.

C. A. Smith, manager of technical liaison, Electro-Optics Division, Tektronix, Inc., Schubert Electronic Products Inc., Shorewood, Ill., and **Lawson M. Jollies**, manager of technical liaison.

Alvey W. Mandel, chief electronics engineer, Bell Telephone Co., Fort Worth, Tex., succeeded Ossie G. Nathan, who was promoted to the vice president of Bell Telephone Co.'s Avionics Division, Buffalo, N.Y.

Arnold F. Kress, director of corporate planning, Cetron Wright Corp., Woodbury, N.J.

William J. Miles, chief project manager, Binghamton Laboratory, Lackawanna, N.Y.

Michael A. Moncada appointed manager for the newly established Phil. Mktg. (Sales) facility of Farrel Corp. & its International Division, Project Director.

National Aerospace and Space Electronics has established an office at Martin Co.'s Space Systems Division, Baltimore, Md., to serve in an engineering and consulting center for the Gemini project, and Duke Vogel has been named manager of the office.

Dr. John D. Cooksey, director of the newly established Optoelectronics Division of Photomeric Inc., Rockville, Md.

James E. Brooks, manager, solutions director, Advanced Division of North American Aviation, Inc., Downey, Calif.

Northrop Space Laboratories needs uncompromising men



It takes dedicated men to breathe life into a new undertaking. Determined men, to guide and guard its goals through the inevitable years.

Though newly organized, Northrop Space Laboratories is backed by the full facilities of the Northrop Corporation. It will prove that it needs purposeful men to take up the challenge and grow with it. Will you be one of them? Key spots are now waiting. For scientists, mathematicians, and physicists, to conduct fundamental research on many body problems as applied to an ultra high pressure program. The goals of this program are to study the electrical and physical behavior of materials under ultra high pressure, to investigate the origin, history and structure of the moon and planets, and to find ways to utilize their natural resources.

Scientists, to perform research in nuclear and radio chemistry, and to conceive and carry out investigations in the fields of activation analysis, dosimetry, gamma ray spectrometry, surface phenomena, and numerous other areas.

Stress analysts, to develop fresh analytical techniques and apply them to new space structural concepts, to do stress analysis and design optimization studies on advanced space vehicle structures.

A plasma physicist, to join our growing program in the measurement of plasma properties, electrostatic, dipole, accelerators, and power conversion devices.

A mathematician-physicist, to concentrate on systems analysis and operations research applied to military and nonmilitary space systems.

Physicists experienced in electro optical imaging devices and laser theory, engineers in mathematics interested in detection theory, recognition and tracking, electronic engineers who know their way around statistical communications theory and noise phenomena, an air and orbital man in satellite detection systems.

For more information about these and other opportunities, write to M. C. Propst, Space Personnel Office, 188 East Broadway, New Britain, Connecticut. You will receive a prompt reply.

NORTHROP
An aerospace and electronic company

'hot' fastening problems with high temperature Elastic Stop® nuts

ESNA, pioneer producer of self-locking nuts to military specifications, has solved hundreds of specialized problems related to the destructive effects of extreme heat (or cold!) on bolted connections.

All of the parts shown here—as well as most of the high-temperature designs now accepted as standard for assembling gas turbine engines—originated and were first tested in ESNA's labs.

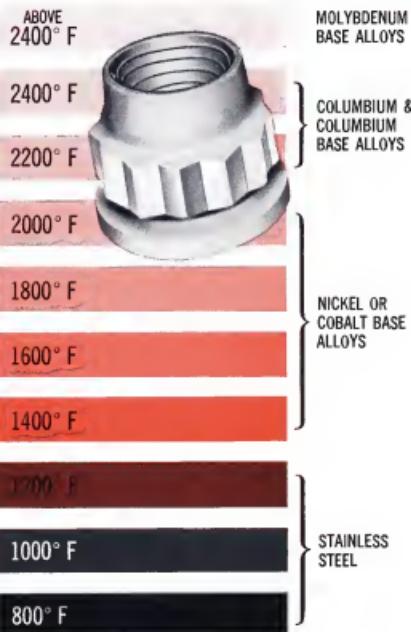
Is your work in these areas?

Recent ESNA engineering developments include: 1. A lightweight nut to carry small tensile loads for at least 30 minutes at 2000°F while retaining locking torque, and to be removable from the bolt after exposure. 2. A nut for use in a radioactive environment, at temperatures to 1200°F, which can be assembled/disassembled by a limited-strength robot hand. 3. A nut for space vehicles which can endure short periods at up to 2700°F while maintaining locking torque resistant to high vibrational loads when returned to lower temperatures.

Come to ESNA for solutions—ready-made or custom-tailored

ESNA may be able to suggest a standard production item to solve your high temperature application problem. If no ready-made answer exists, ESNA has the capability—and the interest—to work with you in the creation of a special solution. Call MUrdock 6-6000, Ext. 201, for engineering assistance. For information about standard high temperature Elastic Stop nuts, write Dept. S74-725.

HEAT COLORS AND APPROXIMATE MAXIMUM WORKING TEMPERATURES OF VARIOUS METALS



Some practical ESNA solutions



LH3858

Reduced hex, high-weight nuts to develop full tensile strength of bolts of 140 KSI at temperatures -300°F to 900°F. 286 stainless steel, silver plated. Sizes 2-56 through 3/8"-24.



LH3610

Special close clearance nuts to develop tensile strength of 160 KSI at temperatures to 900°F when used on bolts of same material. AMS-630A, chrome moly vanadium steel, silver plated. Sizes 10-32 through 3/8"-24.



LH4167

High performance nuts to develop full strength (160 KSI) of bolts of same material at temperatures -300°F to 1400°F. Used for reduced times and loads up to 1800°F. Rene 41, silver plated. 1/4-28 size, two shank lengths.



ZL4361

Shank type nut for turn-bolt flange sections. Develops full tensile strength of Waspalloy bolts up to 1400°F. Waspalloy PWAG686, silver plated. 1/4-28 size, two shank lengths.



RG38-2644

Radial gang nut strip for flange assemblies. Develops full strength of bolts of 347FM or 303. Nut—AlSi 347-FM, silver plated, size 5/16"-24. Channel—AlSi 321 passivated.



ELASTIC STOP NUT CORPORATION OF AMERICA

2330 Vauxhall Road, Union, N. J.